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of

Religion and Ethics

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LISTS OF ABBREVIATIONS

I. General

A.H. = Anno Hijrae (A.D. 622).
Ak. = Akkadian.
Alex. = Alexandrian.
Amer. = American.
Apoc. = Apocalypse, Apocalyptic.
Apocr. = Apocrypha.
Aq. = Aquila.
Arab. = Arabic.
Aram. = Aramaic.
Arm. = Armenian.
Ary. = Aryan.
As. = Asiatic.
Assyr. = Assyrian.
AT = Altes Testament.
AV = Authorized Version.
AVm = Authorized Version margin.
A.Y. = Anno Yazdagird (A.D. 639).
Bab. = Babylonian.
c. = *circa*, about.
Can. = Canaanite.
cf. = compare.
ct. = contrast.
D = Deuteronomist.
E = Elohist.
edd. = editions or editors.
Egyp. = Egyptian.
Eng. = English.
Eth. = Ethiopic.
EV, EVV = English Version, Versions.
f. = and following verse or page.
ff. = and following verses or pages.
Fr. = French.
Germ. = German.
Gr. = Greek.
H = Law of Holiness.
Heb. = Hebrew.
Hel. = Hellenistic.
Hex. = Hexateuch.
Himy. = Himyaritic.
Ir. = Irish.
Iran. = Iranian.
Isr. = Israelite.
J = Jahwist.
J" = Jehovah.
Jerus. = Jerusalem.
Jos. = Josephus.
LXX = Septuagint.
Min. = Minæan.
MSS = Manuscripts.
MT = Massoretic Text.
n. = note.
NT = New Testament.
Onḳ. = Onḳelos.
OT = Old Testament.
P = Priestly Narrative.
Pal. = Palestine, Palestinian.
Pent. = Pentateuch.
Pers. = Persian.
Phil. = Philistine.
Phœn. = Phœnician.
Pr. Bk. = Prayer Book.
R = Redactor.
Rom. = Roman.
RV = Revised Version.
RVm = Revised Version margin.
Sab. = Sabæan.
Sam. = Samaritan.
Sem. = Semitic.
Sept. = Septuagint.
Sin. = Sinaitic.
Skr. = Sanskrit.
Symm. = Symmachus.
Syr. = Syriac.
t. (following a number) = times.
Talm. = Talmud.
Targ. = Targum.
Theod. = Theodotion.
TR = Textus Receptus, Received Text.
tr. = translated or translation.
VSS = Versions.
Vulg., Vg. = Vulgate.
WH = Westcott and Hort's text.

II. Books of the Bible

Old Testament.

Gn = Genesis.
Ex = Exodus.
Lv = Leviticus.
Nu = Numbers.
Dt = Deuteronomy.
Jos = Joshua.
Jg = Judges.
Ru = Ruth.
1 S, 2 S = 1 and 2 Samuel.
1 K, 2 K = 1 and 2 Kings.
1 Ch, 2 Ch = 1 and 2 Chronicles.
Ezr = Ezra.
Neh = Nehemiah.
Est = Esther.
Job.
Ps = Psalms.
Pr = Proverbs.
Ec = Ecclesiastes.
Ca = Canticles.
Is = Isaiah.
Jer = Jeremiah.
La = Lamentations.
Ezk = Ezekiel.
Dn = Daniel.
Hos = Hosea.
Jl = Joel.
Am = Amos.
Ob = Obadiah.
Jon = Jonah.
Mic = Micah.
Nah = Nahum.
Hab = Habakkuk.
Zeph = Zephaniah.
Hag = Haggai.
Zec = Zechariah.
Mal = Malachi.

Apocrypha.

1 Es, 2 Es = 1 and 2 Esdras.
To = Tobit.
Jth = Judith.
Ad. Est = Additions to Esther.
Wis = Wisdom.
Sir = Sirach or Ecclesiasticus.
Bar = Baruch.
Three = Song of the Three Children.
Sus = Susanna.
Bel = Bel and the Dragon.
Pr. Man = Prayer of Manasses.
1 Mac, 2 Mac = 1 and 2 Maccabees.

New Testament.

Mt = Matthew.
Mk = Mark.
Lk = Luke.
Jn = John.
Ac = Acts.
Ro = Romans.
1 Co, 2 Co = 1 and 2 Corinthians.
Gal = Galatians.
Eph = Ephesians.
Ph = Philippians.
Col = Colossians.
1 Th, 2 Th = 1 and 2 Thessalonians.
1 Ti, 2 Ti = 1 and 2 Timothy.
Tit = Titus.
Philem = Philemon.
He = Hebrews.
Ja = James.
1 P, 2 P = 1 and 2 Peter.
1 Jn, 2 Jn, 3 Jn = 1, 2, and 3 John.
Jude.
Rev = Revelation.

III. For the Literature

1. The following authors' names, when unaccompanied by the title of a book, stand for the works in the list below.

Baethgen = *Beiträge zur sem. Religionsgesch.*, 1888.
Baldwin = *Dict. of Philosophy and Psychology*, 3 vols. 1901–05.
Barth = *Nominalbildung in den sem. Sprachen*, 2 vols. 1889, 1891 ([2]1894).
Benzinger = *Heb. Archäologie*, 1894.
Brockelmann = *Gesch. d. arab. Litteratur*, 2 vols. 1897–1902.
Bruns-Sachau = *Syr.-Röm. Rechtsbuch aus dem fünften Jahrhundert*, 1880.
Budge = *Gods of the Egyptians*, 2 vols. 1903.
Daremberg-Saglio = *Dict. des ant. grec. et rom.*, 1886–90.
De la Saussaye = *Lehrbuch der Religionsgesch.*[3], 1905.
Denzinger = *Enchiridion Symbolorum*[11], Freiburg im Br., 1911.
Deussen = *Die Philos. d. Upanishads*, 1899 [Eng. tr., 1906].
Doughty = *Arabia Deserta*, 2 vols. 1888.
Grimm = *Deutsche Mythologie*[4], 3 vols. 1875–78, Eng. tr. *Teutonic Mythology*, 4 vols. 1882–88.
Hamburger = *Realencyclopädie für Bibel u. Talmud*, i. 1870 ([2]1892), ii. 1883, suppl. 1886, 1891 f., 1897.
Holder = *Altceltischer Sprachschatz*, 1891 ff.
Holtzmann-Zöpffel = *Lexicon f. Theol. u. Kirchenwesen*[2], 1895.
Howitt = *Native Tribes of S.E. Australia*, 1904.
Jubainville = *Cours de Litt. celtique*, i.–xii., 1883 ff.
Lagrange = *Études sur les religions sémitiques*[2], 1904.
Lane = *An Arabic-English Lexicon*, 1863 ff.
Lang = *Myth, Ritual, and Religion*[2], 2 vols. 1899.
Lepsius = *Denkmäler aus Aegypten u. Aethiopien*, 1849–60.
Lichtenberger = *Encyc. des sciences religieuses*, 1876.
Lidzbarski = *Handbuch der nordsem. Epigraphik*, 1898.
McCurdy = *History, Prophecy, and the Monuments*, 2 vols. 1894–96.
Muir = *Orig. Sanskrit Texts*, 1858–72.
Muss-Arnolt = *A Concise Dict. of the Assyrian Language*, 1894 ff.
Nowack = *Lehrbuch d. heb. Archäologie*, 2 vols. 1894.
Pauly-Wissowa = *Realencyc. der classischen Altertumswissenschaft*, 1894 ff.
Perrot-Chipiez = *Hist. de l'art dans l'antiquité*, 1881 ff.
Preller = *Römische Mythologie*, 1858.
Réville = *Religion des peuples non-civilisés*, 1883.
Riehm = *Handwörterbuch d. bibl. Altertums*[2], 1893–94.
Robinson = *Biblical Researches in Palestine*[2], 1856.
Roscher = *Lex. d. gr. u. röm. Mythologie*, 1884 ff.
Schaff-Herzog = *The New Schaff-Herzog Encyclopedia of Religious Knowledge*, 1908 ff.
Schenkel = *Bibel-Lexicon*, 5 vols. 1869–75.
Schürer = *GJV*[3], 3 vols. 1898–1901 [*HJP*, 5 vols. 1890 ff.].
Schwally = *Leben nach dem Tode*, 1892.
Siegfried-Stade = *Heb. Wörterbuch zum AT*, 1893.
Smend = *Lehrbuch der alttest. Religionsgesch.*[2], 1899.
Smith (G. A.) = *Historical Geography of the Holy Land*[4], 1897.
Smith (W. R.) = *Religion of the Semites*[2], 1894.
Spencer (H.) = *Principles of Sociology*[3], 1885–96.
Spencer-Gillen[a] = *Native Tribes of Central Australia*, 1899.
Spencer-Gillen[b] = *Northern Tribes of Central Australia*, 1904.
Swete = *The OT in Greek*, 3 vols. 1893 ff.
Tylor (E. B.) = *Primitive Culture*[3], 1891 [[4]1903].
Ueberweg = *Hist. of Philosophy*, Eng. tr., 2 vols. 1872–74.
Weber = *Jüdische Theologie auf Grund des Talmud u. verwandten Schriften*[2], 1897.
Wiedemann = *Die Religion der alten Aegypter*, 1890 [Eng. tr., revised, *Religion of the Anc. Egyptians*, 1897].
Wilkinson = *Manners and Customs of the Ancient Egyptians*, 3 vols. 1878.
Zunz = *Die gottesdienstlichen Vorträge der Juden*[2], 1892.

2. Periodicals, Dictionaries, Encyclopædias, and other standard works frequently cited.

AA = Archiv für Anthropologie.
AAOJ = American Antiquarian and Oriental Journal.
ABAW = Abhandlungen d. Berliner Akad. d. Wissenschaften.
AE = Archiv für Ethnographie.
AEG = Assyr. and Eng. Glossary (Johns Hopkins University).
AGG = Abhandlungen der Göttinger Gesellschaft der Wissenschaften.
AGPh = Archiv für Geschichte der Philosophie.
AHR = American Historical Review.
AHT = Ancient Hebrew Tradition (Hommel).
AJPh = American Journal of Philology.
AJPs = American Journal of Psychology.
AJRPE = American Journal of Religious Psychology and Education.
AJSL = American Journal of Semitic Languages and Literature.
AJTh = American Journal of Theology.
AMG = Annales du Musée Guimet.
APES = American Palestine Exploration Society.
APF = Archiv für Papyrusforschung.
AR = Anthropological Review.
ARW = Archiv für Religionswissenschaft.
AS = Acta Sanctorum (Bollandus).
ASG = Abhandlungen der Sächsischen Gesellschaft der Wissenschaften.
ASoc = L'Anuée Sociologique.
ASWI = Archæological Survey of W. India.
AZ = Allgemeine Zeitung.
BAG = Beiträge zur alten Geschichte.
BASS = Beiträge zur Assyriologie u. sem. Sprachwissenschaft (edd. Delitzsch and Haupt).
BCH = Bulletin de Correspondance Hellénique.
BE = Bureau of Ethnology.
BG = Bombay Gazetteer.
BJ = Bellum Judaicum (Josephus).
BL = Bamptou Lectures.
BLE = Bulletin de Littérature Ecclésiastique.
BOR = Bab. and Oriental Record.
BS = Bibliotheca Sacra.
BSA = Annual of the British School at Athens.
BSAA = Bulletin de la Soc. archéologique à Alexandrie.
BSAL = Bulletin de la Soc. d'Anthropologie de Lyon.
BSAP = Bulletin de la Soc. d'Anthropologie, etc., Paris.
BSG = Bulletin de la Soc. de Géographie.
BTS = Buddhist Text Society.
BW = Biblical World.
BZ = Biblische Zeitschrift.

CAIBL = Comptes rendus de l'Académie des Inscriptions et Belles-Lettres.
CBTS = Calcutta Buddhist Text Society.
CE = Catholic Encyclopædia.
CF = Childhood of Fiction (MacCulloch).
CGS = Cults of the Greek States (Farnell).
CI = Census of India.
CIA = Corpus Inscrip. Atticarum.
CIE = Corpus Inscrip. Etruscarum.
CIG = Corpus Inscrip. Græcarum.
CIL = Corpus Inscrip. Latinarum.
CIS = Corpus Inscrip. Semiticarum.
COT = Cuneiform Inscriptions and the OT [Eng. tr. of *KAT*²; see below].
CR = Contemporary Review.
CeR = Celtic Review.
ClR = Classical Review.
CQR = Church Quarterly Review.
CSEL = Corpus Script. Eccles. Latinorum.
DAC = Dict. of the Apostolic Church.
DACL = Dict. d'Archéologie chrétienne et de Liturgie (Cabrol).
DB = Dict. of the Bible.
DCA = Dict. of Christian Antiquities (Smith-Cheetham).
DCB = Dict. of Christian Biography (Smith-Wace).
DCG = Dict. of Christ and the Gospels.
DI = Dict. of Islam (Hughes).
DNB = Dict. of National Biography.
DPhP = Dict. of Philosophy and Psychology.
DWAW = Denkschriften der Wiener Akad. der Wissenschaften.
EBi = Encyclopædia Biblica.
EBr = Encyclopædia Britannica.
EEFM = Egyp. Explor. Fund Memoirs.
EI = Encyclopaedia of Islām.
ERE = The present work.
Exp = Expositor.
ExpT = Expository Times.
FHG = Fragmenta Historicorum Græcorum (coll. C. Müller, Paris, 1885).
FL = Folklore.
FLJ = Folklore Journal.
FLR = Folklore Record.
GA = Gazette Archéologique.
GB = Golden Bough (Frazer).
GGA = Göttingische Gelehrte Anzeigen.
GGN = Göttingische Gelehrte Nachrichten (Nachrichten der königl. Gesellschaft der Wissenschaften zu Göttingen).
GIAP = Grundriss d. Indo-Arischen Philologie.
GIrP = Grundriss d. Iranischen Philologie.
GJV = Geschichte des jüdischen Volkes.
GVI = Geschichte des Volkes Israel.
HAI = Handbook of American Indians.
HDB = Hastings' Dict. of the Bible.
HE = Historia Ecclesiastica.
HGHL = Historical Geography of the Holy Land (G. A. Smith).
HI = History of Israel.
HJ = Hibbert Journal.
HJP = History of the Jewish People.
HL = Hibbert Lectures.
HN = Historia Naturalis (Pliny).
HWB = Handwörterbuch.
IA = Indian Antiquary.
ICC = International Critical Commentary.
ICO = International Congress of Orientalists.
ICR = Indian Census Report.
IG = Inscrip. Græcæ (publ. under auspices of Berlin Academy, 1873 ff.).
IGA = Inscrip. Græcæ Antiquissimæ.
IGI = Imperial Gazetteer of India² (1885); new edition (1908–09).
IJE = International Journal of Ethics.
ITL = International Theological Library.
JA = Journal Asiatique.
JAFL = Journal of American Folklore.
JAI = Journal of the Anthropological Institute.
JAOS = Journal of the American Oriental Society.
JASB = Journal of the Anthropological Society of Bombay.
JASBe = Journ. of As. Soc. of Bengal.
JBL = Journal of Biblical Literature.
JBTS = Journal of the Buddhist Text Society.
JD = Journal des Débats.
JDTh = Jahrbücher f. deutsche Theologie.
JE = Jewish Encyclopedia.
JGOS = Journal of the German Oriental Society.
JHC = Johns Hopkins University Circulars.
JHS = Journal of Hellenic Studies.
JLZ = Jenäer Litteraturzeitung.
JPh = Journal of Philology.
JPTh = Jahrbücher für protestantische Theologie.
JPTS = Journal of the Pāli Text Society.
JQR = Jewish Quarterly Review.
JRAI = Journal of the Royal Anthropological Institute.
JRAS = Journal of the Royal Asiatic Society.
JRASBo = Journal of the Royal Asiatic Society, Bombay branch.
JRASC = Journal of the Royal Asiatic Society, Ceylon branch.
JRASK = Journal of the Royal Asiatic Society, Korean branch.
JRGS = Journal of the Royal Geographical Society.
JRS = Journal of Roman Studies.
JThSt = Journal of Theological Studies.
*KAT*² = Die Keilinschriften und das AT² (Schrader), 1883.
*KAT*³ = Zimmern-Winckler's ed. of the preceding (really a totally distinct work), 1903.
KB or *KIB* = Keilinschriftliche Bibliothek (Schrader), 1889 ff.
KGF = Keilinschriften und die Geschichtsforschung, 1878.
LCBl = Literarisches Centralblatt.
LOPh = Literaturblatt für Oriental. Philologie.
LOT = Introduction to Literature of OT (Driver).
LP = Legend of Perseus (Hartland).
LSSt = Leipziger sem. Studien.
M = Mélusine.
MAIBL = Mémoires de l'Acad. des Inscriptions et Belles-Lettres.
MBAW = Monatsbericht d. Berliner Akad. d. Wissenschaften.
MGH = Monumenta Germaniæ Historica (Pertz).
MGJV = Mittheilungen der Gesellschaft für jüdische Volkskunde.
MGWJ = Monatsschrift für Geschichte und Wissenschaft des Judentums.
MI = Origin and Development of the Moral Ideas (Westermarck).
MNDPV = Mittheilungen u. Nachrichten des deutschen Palästina-Vereins.
MR = Methodist Review.
MVG = Mittheilungen der vorderasiatischen Gesellschaft.
MWJ = Magazin für die Wissenschaft des Judentums.
NBAC = Nuovo Bullettino di Archeologia Cristiana.
NC = Nineteenth Century.
NHWB = Neuhebräisches Wörterbuch.
NINQ = North Indian Notes and Queries.
NKZ = Neue kirchliche Zeitschrift.
NQ = Notes and Queries.
NR = Native Races of the Pacific States (Bancroft).
NTZG = Neutestamentliche Zeitgeschichte.
OED = Oxford English Dictionary.
OLZ = Orientalische Litteraturzeitung.
OS = Onomastica Sacra.
OTJC = Old Testament in the Jewish Church (W. R. Smith).
OTP = Oriental Translation Fund Publications.
PAOS = Proceedings of American Oriental Society.

PASB = Proceedings of the Anthropological Soc. of Bombay.
PB = Polychrome Bible (English).
PBE = Publications of the Bureau of Ethnology.
PC = Primitive Culture (Tylor).
PEFM = Palestine Exploration Fund Quarterly Memoirs.
PEFSt = Palestine Exploration Fund Statement.
PG = Patrologia Græca (Migne).
PJB = Preussische Jahrbücher.
PL = Patrologia Latina (Migne).
PNQ = Punjab Notes and Queries.
PR = Popular Religion and Folklore of N. India (Crooke).
PRE^3 = Prot. Realencyclopädie (Herzog-Hauck).
PRR = Presbyterian and Reformed Review.
PRS = Proceedings of the Royal Society.
PRSE = Proceedings Royal Soc. of Edinburgh.
PSBA = Proceedings of the Society of Biblical Archæology.
PTS = Pāli Text Society.
RA = Revue Archéologique.
RAnth = Revue d'Anthropologie.
RAS = Royal Asiatic Society.
RAssyr = Revue d'Assyriologie.
RB = Revue Biblique.
RBEW = Reports of the Bureau of Ethnology (Washington).
RC = Revue Critique.
RCel = Revue Celtique.
RCh = Revue Chrétienne.
RDM = Revue des Deux Mondes.
RE = Realencyclopädie.
REG = Revue des Études Grecques.
REg = Revue Égyptologique.
REJ = Revue des Études Juives.
REth = Revue d'Ethnographie.
RGG = Die Religion in Geschichte und Gegenwart.
RHLR = Revue d'Histoire et de Littérature religieuses.
RHR = Revue de l'Histoire des Religions.
RMM = Revue du monde musulman.
RN = Revue Numismatique.
RP = Records of the Past.
RPh = Revue Philosophique.
RQ = Römische Quartalschrift.
RS = Revue sémitique d'Épigraphie et d'Hist. ancienne.
RSA = Recueil de la Soc. archéologique.
RSI = Reports of the Smithsonian Institution.
RTAP = Recueil de Travaux rélatifs à l'Archéologie et à la Philologie.
RTP = Revue des traditions populaires.
RThPh = Revue de Théologie et de Philosophie.
RTr = Recueil de Travaux.
RVV = Religionsgeschichtliche Versuche und Vorarbeitungen.
RWB = Realwörterbuch.
SBAW = Sitzungsberichte d. Berliner Akademie d. Wissenschaften.
SBB = Sacred Books of the Buddhists.
SBE = Sacred Books of the East.
SBOT = Sacred Books of the OT (Hebrew).
SDB = Single-vol. Dict. of the Bible (Hastings).
SK = Studien und Kritiken.
SMA = Sitzungsberichte d. Münchener Akademie.
SSGW = Sitzungsberichte d. Kgl. Sächs. Gesellsch. d. Wissenschaften.
SWAW = Sitzungsberichte d. Wiener Akademie d. Wissenschaften.
TAPA = Transactions of American Philological Association.
TASJ = Transactions of the Asiatic Soc. of Japan.
TC = Tribes and Castes.
TES = Transactions of Ethnological Society.
ThLZ = Theologische Litteraturzeitung.
ThT = Theol. Tijdschrift.
TRHS = Transactions of Royal Historical Society.
TRSE = Transactions of Royal Soc. of Edinburgh.
TS = Texts and Studies.
TSBA = Transactions of the Soc. of Biblical Archæology.
TU = Texte und Untersuchungen.
WAI = Western Asiatic Inscriptions.
WZKM = Wiener Zeitschrift f. Kunde des Morgenlandes.
ZA = Zeitschrift für Assyriologie.
ZÄ = Zeitschrift für ägyp. Sprache u. Altertumswissenschaft.
ZATW = Zeitschrift für die alttest. Wissenschaft.
ZCK = Zeitschrift für christliche Kunst.
ZCP = Zeitschrift für celtische Philologie.
ZDA = Zeitschrift für deutsches Altertum.
ZDMG = Zeitschrift der deutschen morgenländischen Gesellschaft.
ZDPV = Zeitschrift des deutschen Palästina-Vereins.
ZE = Zeitschrift für Ethnologie.
ZKF = Zeitschrift für Keilschriftforschung.
ZKG = Zeitschrift für Kirchengeschichte.
ZKT = Zeitschrift für kathol. Theologie.
ZKWL = Zeitschrift für kirchl. Wissenschaft und kirchl. Leben.
ZM = Zeitschrift für die Mythologie.
ZNTW = Zeitschrift für die neutest. Wissenschaft.
ZPhP = Zeitschrift für Philosophie und Pädagogik.
ZTK = Zeitschrift für Theologie und Kirche.
ZVK = Zeitschrift für Volkskunde.
ZVRW = Zeitschrift für vergleichende Rechtswissenschaft.
ZWT = Zeitschrift für wissenschaftliche Theologie.

[A small superior number designates the particular edition of the work referred to, as *KAT*^{2}, *LOT*^{6}, etc.]

Symposium and the Socrates of the *Phædo* and leaves their reconciliation to the ingenuity of modern interpretation. Will the sage take part in politics? To this question of the later schools the idealist Plato answers: 'Only in the politics of his own city, the city of God.'[1] But Plato's practical decision appears in the prescription of the *Republic* that the philosopher must descend into the cave to help his fellowman,[2] in his journeys to the court of Syracuse, and in his devotion of the last years of his life to the laborious composition of the *Laws*.

In Aristotle the contradiction is disguised, but pervades the entire *Ethics*. Happiness is activity in accordance with virtue,[3] but it finally appears that there are intellectual as well as moral virtues,[4] and the highest activity is the pure contemplation of thought which the student may enjoy interruptedly and God eternally.[5] The life in accordance with ethical virtue is secondary.[6] The Stoic sage is distinguished from the Cyrenaic and Epicurean in Horace[7] by his immersion in political activities.

Chrysippus said that Aristotle's theoretic life was only a form of hedonism.[8] The literature of Stoicism harps on the word *κοινωνικός*, as the literature of to-day on the words 'social' and 'socialized.' And many modern critics have taken the Stoics at their own estimate and praised Stoicism on this score as against Platonism. But Cicero points out that in fact the Academy and the Lyceum were the chief schools of oratory and political science. And Seneca says epigrammatically:

'Quorum tamen nemo ad rempublicam accessit, at nemo non misit.'[9]

14. Neo-Platonism.—The divorce between culture and life in the declining period of the Græco-Roman empire confirmed these tendencies, and Neo-Platonism, the predominant philosophy of the last three centuries, constructed its system and its ideal out of the eloquent passages of the *Phædo*, the *Gorgias*, the *Republic*, and the *Theætetus* that preach purification from sin or sensualism, flight from the world, concentration of the mind upon itself, and assimilation of the human to the divine as the way of salvation and of good.[1] These conceptions were blended with the doctrine, derived from the Platonic *Symposium* and Aristotle's *Metaphysics*, of the upward striving and aspiration of all creatures towards the primal source of the good and the beautiful, God.

It is not a practicable final philosophy of the supreme human good for any race of men in whom the will to live persists. It is only the beautiful legacy which the dying philosophy of Greece bequeathed to the idealism and the religious poetry of the world:

'If, in the silent mind of One all-pure,
At first imagined lay
The sacred world;
. . . . . .
O waking on a world which thus-wise springs!
. . . O waking on life's stream!
By lonely pureness to the all-pure fount
(Only by this thou canst) the colour'd dream
Of life remount!'[2]

With this poetic interpretation of Matthew Arnold we may compare the last words of Plotinus' *Enneades*, *φυγή*, with Plato, *Theæt.* 176 B, *φυγὴ δὲ ὁμοίωσις θεῷ κατὰ τὸ δυνατόν*, and with the closing words of Emerson's last essay, 'Illusions,' in his *Conduct of Life*: 'They alone with him alone.' But the final good of Plato and of Greece in her prime is rather that of Tennyson's *Ancient Sage*:

'Let be thy wail
And help thy fellow men.'

LITERATURE.—See the works cited in the footnotes.

PAUL SHOREY

SUN, MOON, AND STARS.

Introductory (F. VON OEFELE), p. 48.
Primitive (E. N. FALLAIZE), p. 62.
American (S. HAGAR), p. 65.
Babylonian.—See INTRODUCTION.
Buddhist (E. J. THOMAS), p. 71.
Celtic (G. DOTTIN), p. 73.
Chinese (T. FU), p. 74.
Egyptian.—See INTRODUCTION.
Greek and Roman.—See INTRODUCTION.
Hebrew (M. A. CANNEY), p. 80.
Hindu (A. S. GEDEN), p. 83.
Iranian (A. V. W. JACKSON), p. 85.
Japanese (M. ANESAKI), p. 88.
Jewish.—See INTRODUCTION.
Muhammadan (C. A. NALLINO), p. 88.
Semitic.—See INTRODUCTION.
Teutonic and Balto-Slavic (E. WELSFORD). p. 101.

SUN, MOON, AND STARS (Introduction).—In every quarter of the globe the star-studded heavens have attracted the attention and challenged the scrutiny of mankind. Very especially was this the case in the low-lying plain of Babylonia, with its pellucid atmosphere, and hence the study of astrology and astronomy, while practically universal, reached a remarkably high stage of development in that region. On the one hand, the fixed stars, of various degrees of brilliance, are ranged immovably in groups that stamp themselves upon the visual organs; while, on the other, the moon, the sun, and the five visible planets seem to be constantly changing their respective positions. Such phenomena were interpreted by primitive man in a subjective and anthropomorphic fashion, and his notions regarding them were still in vogue when genuine scientific inquiry entered the field, so that until about 1500 A.D. astrology and astronomy remained an inextricable mass of confusion.

1. The seven planets.—In the northern regions of the Old World every object was regarded by the primitive mind not merely as personal, but also as sexual. In the north-east the twin concepts of *Yang* and *Yin* long survived amongst the Chinese as a philosophical formula, classifying all existing things as male (= good) or female (= evil). Persian dualism retains the twofold principle in its most incisive form. In the Middle Ages, Christian ideas were for a time excessively influenced by the antithesis of God and Satan, though here the sexual dichotomy characteristic of the primitive mind has disappeared.

Now this tendency of the aboriginal mind towards sexual personification left some of its earliest deposits upon the observation and study of the stars. Even the simplest observations of the planetary movements brought to light the striking fact that

1 *Rep.* 592 A B.
2 *Ib.* 529 E, 519 B. The ingenious suggestion that this is the Orphic *κατάβασις* exemplifies again the danger of over-stressing Plato's imagery as against his meanings.
3 1102 a 5 ff.
4 1103 a 5, *Ethics*, bk. vi.; Plato, *Rep.* 518 D E.
5 1177 a 12, 1178 b, *de Cœlo*, 292 a 22.
6 1178 a 9.
7 *Ep.* i. i. 16 f. 8 Hicks, p. 54.
9 *De Tranquillitate Animi*, i. 7.

1 On this aspect of Plato's own philosophy cf. E. Zeller, *Plato and the Older Academy*, Eng. tr., London, 1876, p. 440 ff., and O. Apelt, *Platonische Aufsätze*, Leipzig, 1912, p. 147 ff., 'Der Wert des Lebens.'
2 Matthew Arnold, 'In Utrumque Paratus' (*Poems*, ed London, 1881, i. 70).

the elongations of the two inferior planets, Mercury and Venus, never reached beyond a certain limit, and that these bodies traversed the zodiac as if held within the magic circle of the sun. The moon and the three superior planets were less restricted in their motions. It was therefore quite in keeping with the imaginative and symbolizing proclivity of the primitive intellect to represent the Sun, Mercury, and Venus as a family, travelling, in relatively close company, like nomads in the ecliptic. Of this family the Sun came to be regarded as the father, Venus as the mother, and Mercury as their son. The other planets were looked upon as mere vagrant males, who on occasion, however, might act as a disturbing influence in the union of the Sun and Venus.

In speculations of a still earlier period it was the sun and moon alone that formed the marriage relationship, the sun being usually the husband and the moon the wife; only in exceptional cases were the positions reversed. Occasionally, too, the relations between sun and moon were represented as homosexual and pederastic. But in the ancient Orient and in Egypt the septet of planets had already attained to such prominence in comparison with the two greater luminaries that the idea of a marriage between sun and moon hardly left a trace behind.

Even in the most remote ages the periods of revolution peculiar to the several planets had been studied, with results which led to their being arranged in the following sequence (with the earth, of course, at the centre of the universe)—Moon, Mercury, Venus, Sun, Mars, Jupiter, Saturn. The sun's superiority in size was enough of itself to give him the median position. The planets named before the sun alternated as morning and evening stars, or in other ways; and of the twofold characteristic thus exhibited one aspect might be regarded as good and the other as evil. The three last-named, or exterior, planets formed a triad by themselves, and they appeared to the observer as less under the control of the sun than his own family or the moon. The middle place amongst them was occupied by Jupiter, who might thus be deemed their king; and the king as such, according to Oriental ideas, was good. But as the sun, the giver of life and light, was likewise good, it followed that Mars and Saturn must be evil—by the principle of alternation, namely, which is even yet resorted to, as, *e.g.*, in the counting of one's coat-buttons, in ideas about even and odd, and in other primitive superstitions. Mars with his relatively short period of revolution became the youthful turbulent demon, while the slowly-revolving Saturn was figured as the hoary-headed begetter of evil.

Not only, however, do men look upwards towards the planets, but the planets themselves look downwards upon men and events on the earth. They were even supposed to impress their own characters upon earthly affairs, intervening therein as their nature prompted. In the case of the sun and the moon such action was obvious to all, and by analogy it was attributed to the other five planets as well. These ideas were so simple and natural that, at the time when, in the oldest civilized lands, such as Babylonia and Egypt, the earliest scientific observations and records of the planetary motions were collected, they had permeated all study of the subject. The consequence was that these naive ideas continued to mingle with the subsequent results of genuine astronomical inquiry.

Aboriginal man came upon a fresh vein of ideas when he divined a mutual connexion between the lustre of the stars and that of the metals. The metals with which he was acquainted being precisely seven in number, it was natural to associate with them, not the fixed stars, but the seven planets. The parallels were as follows: the Sun with gold, the Moon with silver, Mars with iron, Mercury with quicksilver, Jupiter with tin, Venus with copper, and Saturn with lead. Hence in mediæval, and even until modern, times, the metals were indicated by the planetary symbols. Then alchemy attached special symbols to other substances; and as alchemy and astrology were intimately connected with each other throughout their entire course, it may be well to give a list of the symbols used by alchemists in the Middle Ages:—

☉ gold, ☾ silver, ♂ iron, ☿ quicksilver, ♃ tin, ♀ copper, ♄ lead, ♁ antimony, ♆ lime, ♎ sulphur, ♕ tartar, ⊖ salt, ⏀ saltpetre, ⊕ sulphuric acid, ✻ ammonia, ⏜ distillate and sublimate, ⏝ precipitate. As will be shown in dealing with the horoscope, the symbols of the four traditional elements were derived from the two 'houses' known as *ὑπόγειον* and *μεσουράνημα* respectively.

We have thus sketched the main lines of thought by which the planets came to have their particular significance in astrological speculation. More remote considerations must here be left aside. Suffice it to say that, in the final scheme of astrology, Mercury became the lord of wisdom, cunning, artifice, and craft, and was likewise bi-sexual; Venus became the lady of love; Mars, the lord of war and violence generally; Jupiter, the ruler of gods and men; Saturn, the lord of cruelty and truculence. The Sun, Jupiter, and Saturn were propitious by day, and the Moon, Mars, and Venus by night. The planets infected with their own qualities such as were born under their influence, but in certain situations their normal action might be completely reversed.

2. The ecliptic and the zodiac.—Civilized man is still affected by the variation of times and seasons, and in a yet higher degree this was the case with primitive man. The latter could hardly remain inattentive to changes of temperature and weather in their connexion with day and night, or with summer and winter, or, again, with the varying position of the sun in the sky. In his ingathering of marine products for daily food and his cruising expeditions off the coast he became aware of the connexion between the ebb and flow of the sea and the course of the moon. His interest in the chase and his sexual relations obliged him to take notice of the fluctuating brightness of the moon by night. He noted that the period of menstruation coincided with that of a lunar revolution. In the life of primitive man, accordingly, there was no concern of importance but was somehow related to the movements of the sun or the moon. As soon, however, as the planets came to be regarded as endowed with personality, the interventions of sun and moon in human affairs began to be thought of as the conscious and voluntary actions of higher beings, whose purpose it was to bring the fortunes of nations, monarchs, and individual human beings into continuous correlation with their own particular activities in the higher sphere.

The planets Venus and Mercury, being represented as respectively the wife and the son of the sun, must inevitably, according to human notions, exert an influence upon the actions of the being personified as husband and father. But, this being so, it was impossible to leave Mars, Jupiter, and Saturn out of account. Now these five smaller planets, equally with the larger two, confined their movements to a certain narrow belt of the firmament. The only difference between the circular paths of the sun and the moon and the

paths of the smaller planets is that the latter exhibit certain peculiar convolutions, which were called epicycles, and may be illustrated by a curved line as follows: . The orbits of the sun and the moon, no doubt, also showed many deviations from the path of simple revolution about the observer's own point of view. But the only change which a dweller upon the earth could discern in the smaller planets was the shifting of their several positions among the fixed stars, and their concomitant variations in apparent magnitude. Investigation of these planets, therefore, did not reach beyond investigation of their paths in the firmament.

After sunset about one-half of all the stars are visible. The great mass of these lie in the broad equatorial girdle of the heavens between the sun and a point 180° E. of the sun. The lines bounding the stars of the circumpolar vault and those of the southern hemisphere are not constant, but fluctuate inversely. The stars, however, that come into consideration in regard to the planetary orbits travel from east to west, passing below the horizon one after another, so that just before sunrise the other half of the stars, *i.e.* those lying between the sun and 180° W., are within the field of view. Thus, an examination of the sky made twice in one night, viz. shortly after sunset and shortly before sunrise, will embrace practically every important phenomenon in the starry heavens. These accordingly were the two times of astronomical observation to which prime importance was ascribed throughout antiquity, and into relation with which all observations were brought.

In the course of one night, then, primitive man could see almost all the stars visible in our latitude. One of the few exceptions was formed by the stars which happened to be situated in the sun's meridian for the time being. Their light was lost in the sun's beams, and they were meanwhile invisible. After sunset and before sunrise, moreover, there was a short period of twilight, causing a degree of obscuration such that brighter stars remained visible only when they were over 12°, and fainter stars only when over 15°, E. or W. of the sun. In virtue of the sun's movement in the zodiac, the observer of the morning and the evening sky might witness the following phenomenon. On a particular evening of the year a star, especially one situated in the zodiacal belt, would be visible for a few minutes after sunset, and on the following evening be seen no more. Now, such a star remained invisible for a certain time every year, and the astrologer spoke of it as being 'combust,' *i.e.* dissolved in the overpowering beams of the sun. Then, after a period of 24 to 30 days, according to its brilliance, the same star reappeared shortly before sunrise. The star's disappearance from the evening sky in the west was termed its heliacal setting, and its reappearance in the morning sky to the east its heliacal rising.

In the astrology and astronomy of both East and West throughout the entire ancient era the heliacal rising of various groups of stars was carefully noted, and employed in registering the date of events. So far, the earliest known instance of this, found more than once in historical records, is the heliacal rising of Sirius, the of the Egyptians, which was pronounced Σῶθις, and translated τὸ ἄστρον τὸ τῆς Ἴσιος, by the Greeks. By this means, long before the building of the pyramids, was indicated the beginning of the sidereal year, as well as a particular era of about 1500 years, at the end of which the first day of the sidereal year coincided with that of the tropical year. Half-way through the period of invisibility the star and the sun lie in the same meridian. The corresponding proximity of a star to any of the planets but the sun is called a conjunction, and every conjunction was astrologically of great importance. But when the sun is one of the coincident pair, the occurrence is known as the cosmical rising of the star in question. It is to this cosmical rising, not as in ancient times to the heliacal rising, that special prominence is attached by modern scientific astronomy.

The Egyptian sacred year was subsequently adopted by the Romans as the Julian year, with the intercalation of a day in every fourth year. This computation allowed for the fact that the sun seems to move forward some $\frac{1}{14\frac{1}{4}}$ of his orbit every day. This might have suggested a division of the ecliptic into 365 parts, only a trifling error being thus involved. What was actually done, however, was to divide the great circle into 360 parts, involving a still larger error of adjustment. The calculation of the yearly period and its division into twelve months—of which we shall treat more fully below—together with many other things, were thereby greatly simplified. But the sun's orbit of 360 degrees, with a day for each degree, left some 5¼ days of every year out of account. Now we still speak of a summer solstice and a winter solstice, meaning thereby the two points at which the sun reaches his greatest declination north and south respectively. Originally, however, the residual 5¼ days were divided between the two solstices, the sun being actually represented as pausing in his declination, so that he could still traverse the 360 degrees of the ecliptic in 360 days. In the ancient Egyptian calendar this whole redundant period was transferred to the time just anterior to the heliacal rising of Sirius, five days being inserted in ordinary, and six in leap (or temple) years. In the early Roman calendar the intercalation was made at the winter solstice. To the Babylonian calendar, which, with a displacement of the year's beginning, is still in use as the Jewish calendar, we must return when we deal with lunar computations. Be it noted here, however, that for astrological and astronomical purposes the Babylonians placed the compensatory interval for the most part at the beginning of spring, but sometimes at the beginning of autumn.

The time at which this yearly intercalation was made was dependent in the main upon the fixing of the zero meridian in the movable vault of heaven. The points through which this zero line might be conveniently drawn were, of course, many. Once it was fixed, astronomy and calendar were brought into harmony, and a definite instant established for commencing the day. The Babylonians began the day with sunrise, and the year with the spring equinox, thus placing the zero of the ecliptic upon the first point of Aries. Among the Jews the day began with sunset, and the civil year with the autumn equinox; and, had the Jews studied astronomy independently, they would have drawn the zero of the ecliptic through Libra. In the early Roman, as in our modern, calendar the day is reckoned from midnight, and the year from the winter solstice; here, therefore, the zero would lie in the first point of Capricornus. The Romans, however, as classical writers inform us, borrowed their astronomy and astrology from Babylonia, and accordingly it is the Babylonian zero point that is found among the Romans, as also in later developments, and even in the astronomy of the present day. The Egyptians dated their year from the rise of the Nile on the 19th of July, and the corresponding zero meridian passed through Sirius. With this, however, the beginning of the day did not harmonize, for, according to notices found in the Mantelpaviane and other hieroglyphic texts,

the Egyptian day was reckoned from sunrise. This dislocation likewise is probably due to Babylonian influence of a very remote date.

We have seen that the ecliptic, and indeed the circle generally, was divided into 360 degrees, to correspond approximately with the sun's daily change of position among the stars throughout one year. These divisions, however, were found inconveniently small, and the ecliptic was then portioned out into constellations, each having an arc of 30 degrees, and three subdivisions of 10 degrees, or decanates. This division came about in two ways. In the first place, at any given time something like one-twelfth of the ecliptic was 'combust'; and, secondly, each of these twelfths was traversed by the sun in about the same time as the moon required for one complete revolution. In this way the annual course of the sun was furnished with the 12 zodiacal signs of the ecliptic. Moreover, in the earliest times the synodical period of the moon was divided into three, viz. waxing, dominant, and waning moon, and this division was adhered to by later astrology. Now to each of these synodical thirds of the moon's course corresponded a movement of the sun extending to some 10 degrees, and thus in time arose the division of the ecliptic into 36 decanates.

The trisection of the moon's period just noted probably led in very remote times to the institution of weeks of ten and five days. It does not appear, however, from what we have so far learned of ancient Eastern history, that these measurements had any practical significance. It was only in astrology and astro-mythology, with its historical legends, that the 36 decanates (or the 72 semi-decanates) were actually made use of. This chronometry, no less than that explained above, was in vogue throughout Babylonia and Egypt, if not elsewhere. A final vestige thereof was the Egyptian practice of assigning 401 *ushabti* for the dead—365 for the days of the year and 36 as guardians for the ten-day weeks. In astrology of the higher type, to the time of Kepler, calculations were made by means of the degree and, above all, of the decanate; and the moon from her tenth to her twentieth day was always spoken of as being in her domain. In general, however, the method of reckoning which superseded all others, for both astronomical observation and astrological interpretation, was that of the well-known 12 zodiacal signs, although these were variously designated in the several civilized lands of antiquity. It likewise forms the foundation of the Babylonian scheme of months, as appears from the following parallelism: Libra, *taśritu* (Bab.), Tishri (Heb.), followed by Scorpio, *araḫ-samna* (Bab.), Marcheshvan (Heb.); then Sagittarius, *kislimu* (Bab.), Kislev (Heb.), etc. The names of the months were also indicative of their meteorological conditions; thus, *e.g.*, the winter rainy season was symbolized by Capricornus (originally the marine animal *Hippocampus guttulatus*), Aquarius, and Pisces, all in some way connected with water.

Here, moreover, we again meet with the practice of portioning out good and evil, or rather male and female, alternately. Astrologically the zero point of this distribution lay between Cancer and Leo, approximating, therefore, to that of the Egyptian Sirius-year. Leo, Libra, and Sagittarius came to be regarded as male; Virgo, Scorpio, and Capricornus as female. It is worthy of remark that as a result of this law of alternation the astrologer was actually forced for thousands of years to speak of Taurus as feminine. Then the constellations of the zodiac were also allotted severally to the planets; thus Cancer was assigned to the moon, Leo to the sun, Gemini and Virgo to Mercury, Taurus and Libra to Venus, Aries and Scorpio to Mars, Sagittarius and Pisces to Jupiter, and Capricornus and Aquarius to Saturn. The particular planet was called the 'lord of the mansion' belonging to its respective sign or signs. Tradition tells us, however, that there were other 'gods (or lords) of the mansion.' Those of the Egyptians have been transmitted to us not only by the reports of Marcus Manilius, but also by an almanac notice found in the Ebers Papyrus; some of their names likewise survive in the Coptic designations of the months. A comparison of the various lists shows us that in the course of thousands of years the tradition remained unaltered, though in that of Manilius there is a dislocation to the extent of one zodiacal sign.

The ecliptic of the sun is traversed approximately also by the moon, and in relation to the latter it was measured by a unit of the sun's course, viz. the arc described by the moon in one day. In order to correspond, therefore, with the moon's period of 28 days, the ecliptic was divided afresh into 28 lunar stations. But as the sun, during the moon's sidereal period, has moved onward by about two lunar stations, astrological calculation assumed a period of about 30 lunar stations, *i.e.* the time between one new moon and another, as the measure of a month. In order to delimit these stations, however, the astrologer did not portion out the ecliptic in a fresh series of constellations, but distinguished each of the 28 by a dominant star in the ecliptic. In contradistinction to the older method of dividing the 30 days of the moon's synodical period in three, there arose subsequently the plan of dividing its sidereal period in four. Once in each of these quarters each of the seven planets was recognized as the lord of a lunar station, the order of sequence being the same as that in which, in the horoscope of the hours, the planets became lords of the ascendant at sunrise.[1] Thus came about the division of the sidereal month of 28 days into four weeks of 7 days, with Sun, Moon, Mars, Mercury, Jupiter, Venus, and Saturn as successive lords of the lunar stations in each week. This astrological scheme of naming the days of the week after the rulers of the lunar stations still survives throughout Christendom, while, on the other hand, the canonical books of the Old and New Testaments entirely avoid the use of such designations, distinguishing the days of the week by ordinal numbers alone.

The various locations of the five smaller planets were usually designated by the 12 zodiacal signs into which the sun's path is divided, as is specially shown in regard to Egypt by the Berlin Demotic Papyrus, p. 8279.

3. Spherical astronomy and the astrological houses. — Observations of the astral motions within the scope of natural vision are designated spherical, and when these have been duly adjusted they are, by way of contrast, called cosmical, while the actual occurrences themselves are spoken of as sidereal. Modern scientific astronomy likewise must always take the direct spherical observations as its starting-point, only then proceeding to elaborate its way towards the higher levels of knowledge. The astrology and astronomy of the ancient world never got beyond the spherical stage. Hence it was necessary from the outset to lay down fixed bearings for observational purposes, such as would be furnished by two lines, one run-

[1] If we take the planets, therefore, in the reverse order of their propinquity to the earth, viz. Saturn, Jupiter, Mars, Sun, Venus, Mercury, Moon, and suppose that each planet in turn presides over an hour of the day, then, if, *e.g.*, Saturn presides over the first hour of a particular day, he will also preside over the 8th, 15th, and 22nd hours; the 23rd hour accordingly will fall to Jupiter, the 24th to Mars, and the 1st hour of the new day to the Sun: hence Saturday is followed by Sunday, and so on.

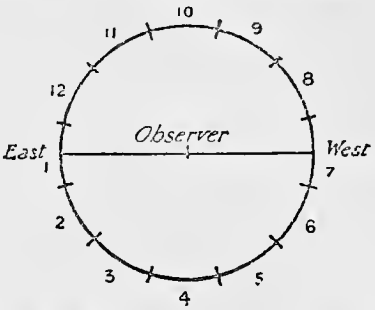
ning east and west, the other north and south, through the observer's own position.

In connexion with nearly all ancient systems of religion are found sacred edifices of great age whose longitudinal axes lie exactly east and west. The determination of this east and west line, *i.e.* the parallel of latitude, was thus one of the early triumphs of the human mind. The oldest known instrument employed for the purpose was the stile, which afterwards developed into the gnomon of the sun-dial, and, indeed, the sun-dial itself. The stile was a vertical shaft fixed in the centre of a circle. In the morning, and again in the evening, the shadow of the pillar extended a considerable distance beyond the circle, while for an hour or two before, as also for an hour or two after, midday the extremity of the shadow lay within the circle. It was necessary, therefore, to mark the two points at which the shadow, forenoon and afternoon, terminated precisely upon the circle. The straight line joining these two points supplied an accurate east and west alignment, which could thus be secured on any sunny day at any season of the year. The use of the gnomon, in some form or another, seems to be common to primitive and the older civilized peoples.

Simple trial and observation showed that a stationary point was to be found in the north pole of the firmament and the star lying nearest to it. The direction of the meridian line through any given point of observation could then be ascertained by the following expedient. Two horoscopers stood face to face upon a line lying roughly north and south. The observer on the south, holding up before him the split rib of a palm leaf, moved it into such a position as enabled him through the fissure to see the pole star directly above the crown of his companion's head. Then the observer on the north, looking through the slit, saw all the then culminating stars from the southern point of the horizon upwards, and in this way projected his meridian upon the celestial vault.

The east and west points of the horizon, and the meridian of the observer, having been ascertained, the earliest facts of observation regarding the paths of the planets could be brought into relation therewith. The fixed stars, indeed, never varying in their positions relative to one another, also rose and set at constant distances from the east and west points respectively. On the other hand, the sun, the moon, and the five smaller planets rose and set at points never twice the same successively, and sometimes north, sometimes south, of due east and west. As regards the sun, the most northerly point of his rising and setting was reached as he entered Cancer, and the most southerly as he entered Capricorn, while his rising and setting were due east and due west respectively twice a year, viz. as he entered Aries and Libra. The extreme limits of his northward and southward movements in the ecliptic were called the tropical points, and the two constellations concerned came to be known in astrology and astronomy as the tropical constellations of the zodiac. Corresponding results were established with reference to the other planets.

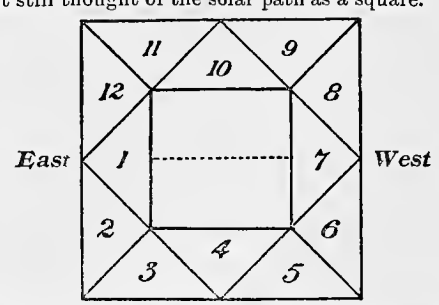
But there is likewise an apparent daily revolution of fixed stars and planets alike around the position of the observer, each of them crossing his meridian once in every 24 hours; while if they lie in the equatorial circle the intersection takes place exactly 6 hours after they rise in the east, and 6 hours before they set in the west. Hence the observer's celestial equator, too, is always laid out in 12 segments corresponding to the 12 constellations of the zodiac; and if we disregard the sun's daily eastward movement of one degree, we find that every two hours the zodiac changes its position relatively to the equator by one whole zodiacal sign of 30 degrees. Now the intermediate positions of the signs during these two hours being left out of account, the observer's celestial equator was once for all divided into 12 apparently stationary parts, each of these having its own meridian. The illustration below shows an equatorial section traversing the horizon and the celestial sphere. These parts were called 'houses,' and all the conditions found within them were treated as if stationed in their respective middle lines. Now, as the enumeration of the houses began in the east, and then proceeded downwards under the eastern horizon, *i.e.* according to the order in which the phenomena of each successive house would appear above that horizon, the due east point fell exactly in the middle of the first house, the due west point in that of the seventh, the meridian in that of the



tenth, and the opposite meridian in that of the fourth. All primitive astronomical and astrological study of the sky was occupied, and indeed necessarily occupied, with the rising, culmination, and setting of the heavenly bodies, with the passage of planets, normal stars, and constellations from one house to another, and with the mutual positions of the planets as measured by the houses they happened to occupy at any given time.

It would appear that these houses were sometimes divided in two, as, *e.g.*, in Egypt in the time of King Seti; and this led quite naturally to the division of the day into 24 hours, and eventually to the arrangement of the dial-plate of our clocks. For more exact observations, however, each house was subdivided into three decanates, and each decanate into ten degrees, the advantage of this being that the sphere of the observer had the same number of parts as the ecliptic, while the boundary lines defining the parts of each coincided every four minutes.

This method of parcelling out the sun's apparent daily course must have been instituted at a very remote period, in an age indeed when the astronomer had not yet grasped the idea of a circular orbit, but still thought of the solar path as a square. In



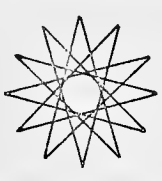
the figure representing the horoscope this quadrate form was retained, and it has remained in use till modern times, and, in fact, till the present day. To this method of delineating the stellar paths in

the horoscope by means of the square we shall frequently have occasion to return, as a considerable number of symbols relating to God and the world were evolved therefrom. In interpreting the horoscope the various positions were so far as possible brought into relation with the first house, and with the latter as starting-point the astrologer, applying the principle of even and odd as in the case of the exterior planets, Sun, Mars, Jupiter, and Saturn, alternately assigned to the other houses an essential character of benefit or bane. Thus the twelfth house was unfavourable, the eleventh favourable, the tenth — apart from its special position—unfavourable, the ninth favourable, the eighth supremely unfavourable, and so with the rest. This mode of interpretation was also arrived at along another line of thought, and, being thus supported by two ostensible proofs, it was believed to be established beyond dispute. The second proof in question was that supplied by the 'aspects,' of which we shall treat presently.

The plan of indicating position by means of zodiacal signs and houses could at best give approximate results. For the sake of simplicity it was assumed that the boundary lines of the several signs always coincided with those of the several houses, and that accordingly at the end of a Babylonian double-hour each sign moved instantaneously into another house, whose number was one less than that of the house which it had vacated. For all further deductions within the limits of plane geometry, the entire contents of any particular zodiacal sign were regarded as concentrated in the middle point of the sign and the house then congruent therewith.

The enumeration of the astrological houses from the east downwards towards the west, then eastwards again above the horizon, so that account is first of all taken of the invisible regions of the stellar heavens, had its origin in the fact that the attention of the astrologer was primarily directed towards the rising of the stars, and accordingly the houses were numbered in the order in which the stars contained in them at any given time would reach the eastern horizon and become visible.

4. **Aspects.** — The term 'aspects' was used in astrology to denote the relative positions of the houses and zodiacal signs, or of the stars situated in the houses at any given time. Planets in the same sign and the same house were said to be in conjunction; planets in opposite signs and houses, in opposition. The other possible relations amongst the celestial phenomena were defined with reference to regular inscribed polygons. Thus, if a planet were situated in the twelfth or the second house, then the line joining the middle point of either of these houses and that of the first house would form one side of a regular inscribed dodecagon; in



which case the planet in question was said to be in dodecagonal aspect to the east point, or 'horoscope' in the original sense. As in the same way planets in the eleventh and third houses furnished the side of a regular hexagon, their aspect towards the east or the horoscope was spoken of as sextile. Similarly planets in the tenth and fourth houses were in quartile or square, and those in the ninth and fifth were in trine. The line joining the middle point of the eighth or the sixth house with the east point was not a constituent part of any regular figure within the circle, and suggested at best a cross dodecagon, formed thus, which was regarded as the violation of all order. But as conjunction and opposition were reckoned amongst the regular aspects, the eighth was the only visible house having no aspect towards the horoscope. The principle of alternate numeration likewise pronounced this house unfavourable. In the astrological application of spherical astronomy it therefore signified the house of death.

Prior to the stage now reached, the exclusive concern of the astronomer had been to map out the heavens with such precision as would enable him to fix his observations by means of a verbal record. His conception of aspects, however, *i.e.* of the relations of the stellar positions to the horoscope, led him to assign values to the stellar positions themselves, and as soon as these came to be represented as anthropocentric or concentric, the initiative was given to the science of Judicial Astrology. Nevertheless we must emphasize the fact that the original scheme of the horoscope was depicted as a square, and that, before it became possible for astrology to speak of regular polygons, the conception of the sun's apparent diurnal motion as a circle must have come to the front. Thus the very language of astrology shows it to have been a kind of excrescence, not inherently connected with astronomy at all. Even in the Middle Ages a distinction was still maintained between Natural Astrology and Positive Astrology. The former dealt with the actual, and especially the baneful, influence of the planets upon meteorological changes—wind, storm, hurricane, thunder, flood, and earthquake. It was accordingly bound up with the naive and fantastic weather-lore of primitive man, and is to some extent still in evidence in scientific meteorology. In regard to the latter it is even yet frequently true that *sub iudice lis est*.

Positive or Judicial Astrology, on the other hand, was concerned from the earliest times with the supposed influences of the planets upon the fortunes of men and nations. It is now regarded by all sober minds as an extravagance of the human intellect, as something that the race has finally left behind. In Judicial Astrology it was no longer merely the aspect of a star to the horoscope, *i.e.* the east point, that was specified and appraised, but also the aspect of two planets with respect to each other. If one planet, for example, was situated in the eleventh house and another in the eighth, the two were said to be mutually in quartile. Here again, moreover, we find the alternate distribution of good and evil: conjunction was good; adjacent aspect or aspect in dodecagon was evil; sextile was good; quartile relatively evil; trine specially good; absence of regular aspect was specially evil, and opposition relatively good.

Since the line between the eighth or the sixth house and the east point did not form the side of a regular inscribed polygon, these two houses were deemed of inferior value. For the anthropocentric mind of the astrologer it was therefore a short step to regard them as houses of misfortune. The eighth house thus became the house of death, and the sixth the house of pains. We shall see later that in the reciprocal relations between the macrocosm and the microcosm the left arm became a synonym for the house of death and the left leg for the house of pains, and that in consequence these bodily parts themselves came to be regarded as of evil omen.

As emphasis was laid likewise upon the mutual correspondence of east and west—an idea that was corroborated by the principle of alternate numbering—the twelfth and second houses were counted

anfavourable. In primitive plane geometry the inscribed triangle and hexagon were deemed pre-eminently regular figures, and once more the alternate enumeration gave the same result. Consequently the eleventh, ninth, fifth, and third houses were reckoned favourable; while the tenth and fourth, again, were relatively evil. These symbolical interpretations, however, were sometimes set aside, sometimes even reversed, especially those connected with the invisible half of the sky.

The tenth house, as that in which the stars culminated, was supposed, by a very natural symbolism, to preside over dignities and offices, while the fourth house, lying directly beneath us, came in similar fashion to be associated with parents and ancestors, as those who had passed into the under world, and inferentially with all the other ties of kinship. On the ground of a certain analogy with the eighth house, *i.e.* that of death, the twelfth became the house of enmity (κακοδαίμων), and, by a further analogy, the second became the house of poverty. As the second house, however, was situated in the sky belonging to the under world and therefore opposite to ours, it became the house of fortune and riches, and for the same reason the sixth house, that of pains (or, according to another interpretation, that of service), became the house of health. Next to the house of death came the ninth as the house of the tutelary deity, while the eleventh, adjacent to the house of enmity, became that of friendship (ἀγαθοδαίμων). On the ground of similar considerations the third became the house of brothers, and the fifth the house of children. Finally, as the first house was specially associated with the querent of the astrological oracle, the seventh belonged to the querent's counterpart, *i.e.* in the ordinary course of things, wife or husband.

The designations of the various houses were therefore as follows: (1) life, (2) riches, (3) brothers, (4) parents, (5) children, (6) health, (7) marriage, (8) death, (9) religion, (10) dignities, (11) friendship, and (12) enmity. But this arrangement gave only the general scheme of astrological prognostication, and in the course of thousands of years various changes were introduced. Our information regarding any particular era of astrological speculation is defective, and we speak only in a general sense when we assert that from first to last the system detailed above remained essentially unchanged. It was all along recognized, moreover, that the scheme must be specially adjusted to special circumstances. Thus in the case of sickness the real querent was the invalid himself, and it was about him, therefore, that the first house supplied information. The counterpart was meanwhile not the wife, but the disease itself, upon which accordingly light was cast by the seventh house. The tenth house, in which the stars culminated over the patient, symbolized the physician, while the fourth, lying directly beneath in the under world, signified medicine. Account was also taken, of course, of the eighth house as the house of death, and of the sixth as the house of health. The houses of friendship, enmity, riches, brothers, and children were not supposed to wield any influence upon the course of the disease. Nor was much importance attached, in such cases, to the symbolism of the sun's planetary family; and, in fact, according to Greek accounts of Egyptian astrology, neither Venus nor Mercury was taken into consideration at all.

5. The astrological conception of the world.—The enormous advances that have been made within modern times in the study and practical application of the natural sciences, as well as the great contrast that obtains between the ancient and the modern scientific point of view, are matters of common knowledge. It is impossible to understand the theories of nature held by the ancients without a clear conception of the difference between their fundamental standpoint and our own. According to the older view of the world, which can be traced backwards for 5000 years before Christ, and which still held unquestioned sway for 1000 years after Christ, all natural objects issued in parallel lines from certain primary causes of universal operation. Modern science, on the other hand, assumes that the various groups of physical phenomena proceed by differentiation from certain primordial forms. While the ancients, therefore, looked upon the diversity of things as original, and their common elements as due to external influences, the moderns assume that the properties which objects have in common are inherited from a single primary form, and that their differences have been produced by external conditions, such as, *e.g.*, the struggle for existence.

The two conceptions, however, are not held stringently apart, nor does history show a rigid line of demarcation between the later and the earlier. Even in Genesis (10[ff.]), for instance, we have a table of nations which stands in complete agreement with the modern point of view, more particularly in the circumstance that it traces back the ancestry of all mankind in a series of converging lines. Much more in accordance with the ancient conception, on the other hand, is the Greek Deluge-story of Deucalion, according to which human beings were generated spontaneously from stones acted upon by the formative powers present in the air.

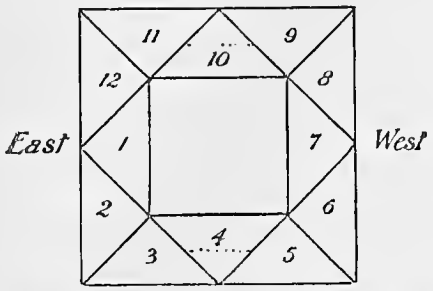
The theory of parallel processes may be called the 'ancient astrological,' or, again, the 'Oriental astrological' view of the universe. It had its birth amongst the early civilizations of the East, and its leading science was astrology; nor is it yet a spent force among certain Asiatic peoples of to-day. Now even our modern science, with its discovery of steam-power and its remarkable utilization of electricity, does not enter so profoundly into contemporary experience as did the ancient astrological conception into the life, thought, and feeling of the distant past.

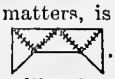
Perhaps the most effective resistance to the more harmful issues of the astrological theory of the universe was made by the peoples living around the Mediterranean. But the Scriptures of the Old and New Testaments are likewise free from the evil outgrowths of that view. Nevertheless, we must remember that even the Biblical writers were children of their time, and could therefore hardly avoid expressing their thoughts in terms of the recognized philosophy of their age. Hence, just as we have come to recognize that the thoroughgoing study of Biblical Hebrew cannot dispense with the philological investigation of Arabic, Ethiopic, Babylonian, Syriac, etc., so we are now beginning to realize the impossibility of understanding the tenor of Biblical modes of expression apart from a knowledge of the astrological conception of the world common to the Babylonian, the Egyptian, and other ancient civilizations.

We must again refer to the square form of the horoscope, as furnishing the ground-plan of this theory of the world. The figure shows us the link which the theory had with astrology, and also with other two occult sciences, viz. Alchemy and the Kabbala.

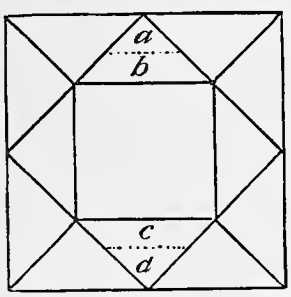
It is of interest to note that the symbols used in astrology for the four cardinal points were simply the triangles corresponding to the first, fourth, seventh, and tenth houses respectively. But while, according to the expedient already noticed (p. 52[a]), the positions of the stars in the ecliptic were determined by the observer on the north, the fixing of the cardinal points was effected by his fellow on the south. The horoscope was therefore seen by the latter from the opposite point of view, and the

four houses in question took a reverse form, so that △ came to mean north, ▽ south, ▷ east, and ◁ west. With this exception, however, all further inferences were drawn from the proper form of the horoscope, *i.e.* from the figure it presented to the observer on the north.



The tenth house, as the *summum cœlum*, and the fourth, as the *imum cœlum*, embraced everything in the world above and the world below respectively. The upper world as a whole, however, consists of the eighth, ninth, tenth, eleventh, and twelfth houses. In the hieroglyphic script of Egypt, accordingly, heaven is represented by the exterior boundary of these five houses, thus: , which, of course, according to the Egyptian practice in such matters, is only a contour, and really stands for  . The same proportions and angles are likewise retained in the Egyptian representation of the goddess of heaven, who broods over the earth-god—a phenomenon which will meet us again when we treat of Egypt. The under world was represented, of course, by the same figure inverted. Now we find two different ideas attaching to each of the houses numbered ten and four. According to one conception the *summum cœlum* contains the heavenly upper ocean, from which rain falls (אֲרֻבֹּת הַשָּׁמַיִם in the Biblical narrative of the Deluge), while the *imum cœlum* embraces both the ocean of the under world and the subterranean water from which the fountains of the deep are fed (מַעְיְנוֹת תְּהוֹם; also the sources of the Nile in Herodotus). According to the other conception there lies above us first of all air, then fire; and beneath us, first earth, then water.

Now the latter theory furnished also the alche-



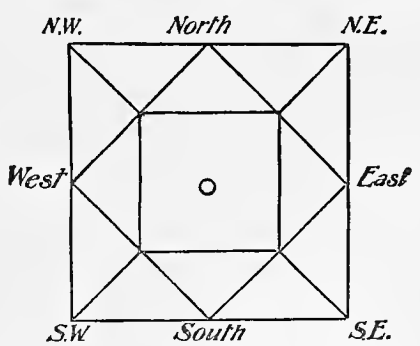
a = Fire △
b = Air ⧋
c = Earth ▽
d = Water ▽

mistic symbols of the elements—symbols which are still written by doctors in old-fashioned mysterious receipts, and were in common use among physicians and apothecaries a hundred years ago. Thus, for example, ▽*sigill.* signified *terra sigillata*; *lumbric.* ▽*restr.* = *lumbrici terrestres*; ▽*flor.* ⊙*rant.* = *aqua florum aurantiorum*; or something was to be boiled *leni* △, *i.e.* *leni calore*. Distilled alcoholic liquors were known as 'burnt water,' and were denoted by a combination of the symbols for water and fire, thus . To this day the device displayed upon rustic inns indicates the licence to sell brandy.

This combined symbol was used not only in alchemy but also in the Kabbala, where it represented the Star of David. It became, in fact, a symbol for God (just as the fire-eye, *i.e.* , was employed in Christian symbolism to signify the Holy Spirit); for, by the rules of the Kabbala, the combination of the principal consonants of אֵשׁ ('fire') and מַיִם ('water') yielded the word שָׁמַיִם ('heaven'), which in its turn was the cabalistic equivalent of אֱלֹהִים ('God'). Thus the term God could be expressed by the secret sign as the synthesis of fire and water. In the synagogue all pictorial representation of God was forbidden, nor was it allowable to give utterance to the tetragram יהוה unless absolutely necessary. In the same way, therefore, as the word אדוני had to be resorted to as the oral designation of God, the symbol came to be used in the architecture of the synagogue as His graphic designation. This figure, moreover, not only contains within itself the symbols of the four elements, interlaced with one another, but, besides the upper and lower triangles signifying fire and water respectively, it also shows four extra-mundane triangles, which could thus be regarded on cabalistic principles as metaphysically symbolizing the four consonants of the tetragram. Hence, even in passages of ancient Christian works where we might expect some such phrase as 'with God,' we actually find the cabalistic device

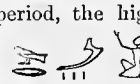
signifying יהוה.

According to the astrological theory of the world, however, not only the perpendicular section through the universe, but the surface of the earth itself, was thought of as quadrate, since the cube, as the ideal geometrical figure, was the accepted symbol of the world as a whole. This idea finds



frequent expression even in later cabalistic writings treating of the origin of salt, which, of course, also crystallizes in cubes. The scheme of the horoscope, accordingly, became a comprehensive map of the world as well. As previously explained in

connexion with the points of the compass, the horoscope was in this case constructed, as it were, from the opposite point of view. In the centre was the navel of the world, which every nation sought to claim for its own territory, and as the site of the national sanctuary. The figure also supplied the four pillars, viz. N.E., N.W., S.E., and S.W., upon which the heavens are supported. Of these the best known was the S.W. pillar, as it was there that Atlas had been relieved by Hercules.

6. Anthropomorphic nomenclature of the sphere.—The square horoscope was not the only expedient resorted to in setting forth the relations of the stars, as another method was also in use among the Egyptians. From a time anterior to Menes until the final period, the high priest of Heliopolis was known as  , *i.e.* 'chief astrologer.' We may note in passing that this office was held by Poti-phera (of which name the literal Greek translation was Heliodoros), the father-in-law of Joseph (Gn 41[45]). Tables of observations made in Egypt during the Twentieth Dynasty are still extant, and in these are recorded the times at which the fixed stars cross the middle lines of the houses, *i.e.* the beginnings of the double-hours. The astrologer on the north found the meridian of the place of observation by looking through the slit of the palm-leaf rib above the bald crown of his companion. The middle meridians of the first and seventh houses were given by the horizontal line, while the observer found those of the eleventh and ninth houses by lines projected over his companion's right and left eyes respectively, and in similar fashion those of the twelfth and eighth houses by lines above the right and left elbows. It is probable that the sixth house was in like manner associated with the left knee, and the second house with the right.

From this point of view the left arm corresponded with the house of death and the left leg with the house of sorrows, and on this account there eventually arose a superstitious aversion to using the word 'left' at all. In particular, all actions performed by the left hand came to be regarded as unlucky. It may well be the case that mankind was right-handed rather than left-handed before astrology asserted its sway, but the ban thus laid upon the left extremities of the body undoubtedly supplied a further reason for excluding the left side and especially the left hand from all actions of great and critical moment.

7. Applied astronomy and astrology.—Alike in the greatest and in the smallest affairs of life uncivilized man is affected by the changes incident to the day and the season, by the phases of the moon by night, and by the ebb and flow of the tides. Hence the observation of sun and moon with a view to a standard measurement of time, or, in other words, to the construction of a calendar, was a vital condition of all progress in civilization. But, as the periods of the earth's rotation about its axis (*i.e.* the apparent diurnal movement of the sun), of the moon's revolution, and of the sun's apparent annual revolution, are incommensurable with regard to each other, the early attempts to frame a serviceable calendar were attended with no small difficulty. As the lunar month made more impression upon the primitive mind than the actual solar year, endeavours were made in the earliest calendars to base the latter upon an integral number of the former, and all sorts of expedients were tried in order to harmonize the two periods. At a further stage in the growth of civilization the determination of the true solar year became the subject of inquiry, the length of the true lunar month being then left out of consideration. Here again, however, the residual fraction of days provided difficulties, and the difference between the calendars of Western Europe and Eastern Europe (Russia) shows that these difficulties have not yet been overcome. In the pre-Christian era there was a disparity between Babylon, with its cyclically adjusted lunar year, and Egypt, with its solar year, or, rather, its two unequal solar years. Other civilizations employed other types of calendar. A purely lunar calendar is still in use among Muhammadans.

The outstanding periodic phenomena of the apparent courses of sun and moon were registered in these calendars, and were celebrated as occasions of joy or sorrow according to their influence upon human life. In such feasts and fasts the moon and the sun were, first of all, personified, and they still continued to be revered as divine or heroic beings even after the particular days connected with their movements by astrology and astronomy had been duly set down in the artificially corrected and adjusted calendars of ancient and modern civilized peoples.

8. Lunar, solar, and planetary deities.—The ascertainment of such varying influences of the moon and the sun as could be registered in the calendar was undoubtedly a forward step in the mental development of primitive man. But the notion that the movements of moon, sun, and planets were effected by powerful and conscious beings, more or less endowed with free will, was an open door to all illusion. The religion and mythology of the lowest races are permeated with this idea. Amongst more highly civilized peoples, again, we find a stock of myths of like purport, which, partly indigenous and partly exotic, forms a kind of illicit religion or superstition, and which shows many points of contrast with the teachings of the recognized national cult. In periods distinguished by a high state of civilization this supplementary religion finds acceptance only amongst the lowest and least enlightened ranks of the people, while at times, when culture is at a low ebb, it extends its sway over the leading classes as well.

In cases, however, where a relatively advanced and purified form of religion found its way into a region already civilized, the old representations of moon and sun as personal beings, as also the narratives that had grafted themselves upon their festivals, degenerated into mere legends. As illustrations of the process we may name the *Metamorphoses* of Ovid in the Roman religion, the stories of the Thousand and One Nights in Islām, and Grimm's domestic and popular tales in Christianized Germany.

But it was also possible that a fusion might take place between the older and the newer narratives. Thus, apart from the sphere of religious history as such, there are many mediæval kings and heroes whose actual experiences, on the one hand, stand forth in the clear light of history, but whose legendary adventures, on the other, show unmistakable deposits from the personifying narratives about the moon and the sun. The same process has been at work practically everywhere; we trace it not only in the *Nibelungenlied* and the *Iliad*, but also in connexion with all the great figures who as gods or prophets occupy the supreme place in the various systems of religion. Popular imagination, in fact, clinging as it does to the ancient legends, is quite indifferent as to the figure around which it throws them; it may fix upon Confucius, Buddha, Zarathushtra, Jesus, or Muhammad. Even the older religions, with deities unmistakably of planetary origin—the Babylonian

Shamash, the Egyptian Rê, the Greek Apollo—show such secondary deposits from various astro-mythological sources.

The disengagement of this secondary astro-mythological element from the Christian system of thought has now become one of the prime tasks of theological criticism. It is no longer possible for any earnest scholar to reject the fundamental idea of such analysis, and the extent to which the work of elimination shall be pursued depends entirely upon whether the individual theologian leans towards the more orthodox or the more liberal side. In regard to Confucius, Buddha, Zarathushtra, and Muhammad, as also in regard to the Alexander romances, the Christian theologian concedes the rights of the method without hesitation. Further, the OT and the Life of Jesus have from ancient times been the nuclei of a mass of legendary stories (the Talmud, etc.; Gospels of the Infancy, etc.), which all theologians have for centuries regarded as apocryphal; and it cannot be disputed that the study of astro-mythology has rendered valuable service in throwing light upon the origin of these spurious additions to the lives of the leading personalities of our religion. Once more, there is a group of writings which, though reckoned apocryphal by evangelical Churches, are still included in the Roman Catholic canon; and, as might be expected, the bearing of the astro-mythological theory upon these writings is estimated by the two great parties within Christianity in precisely opposite ways. And when at length the theory is applied to certain constitutive elements in the OT, and to the life of Jesus as given in the evangelical records, the theologians who concede its rights in these domains are fewer still in number. The explanation of this, of course, is that such criticism seems to undermine the historicity of the Biblical narratives, and to leave nothing but a mass of mythical stories about the planets, which have crystallized around certain more or less unreal figures in the history of Israel. The logical result of the process appears to be the subversion of every constituent of Christianity save its ethics.

Taken in this sense, the comparative study of astrology and astro-mythology rests upon an impregnable foundation. The implications of its results, as was said above, may quite well be brought into harmony alike with the most rigid orthodoxy and the broadest liberalism. Hence it cannot be non-suited by either of the warring schools; it is reconcilable even with the aims of its critics. Just as comparative philology is an ideal and impartial science, so must the comparative study of myths assume a like impartiality; and the indispensable framework of this study is formed by the planetary deities of astrology.

9. Prophetic astrology.—From the theological point of view, prophetic astrology must be regarded as a by-way towards superstition, and, indeed, as one of the main sources of superstition. It was evolved by gentle gradations from what we may call 'calendar astronomy.' Primitive man discerned parallelism not only in the processes of nature, but also in the State and in human life; nay, even in the forms and organs of animals he read analogies and homologies, and many other fields of observation presented similar correspondences. But by far the most obvious and unmistakable cases of parallelism were those which subsisted between the motions of the sun and the moon, on the one hand, and the periodic variation of the tides, of light and heat during the day, and of the seasons, on the other. Hence arose the notion of planetary deities or angels—beings who acted according to highly complicated laws, ordained either by themselves or by a superior power, and who sought to bring all events, great and small alike, within the range of parallel uniformities. Where the trend of thought was polytheistic, the planets were regarded as gods; where it lay towards monotheism, they were but the messengers of a Divine will beyond them; or, as the case might be, an inevitable fate was supposed to hang over the gods themselves.

From the standpoint of the ancient astrologer, the supreme function of all learning was the observation of certain simple phenomena and the drawing of inferences bearing upon a parallel series of facts otherwise veiled. The primary task of astrology was to ascertain the positions of the planets in relation to one another, to the zodiacal signs, and to the observer himself, and then to make deductions therefrom. This was astrology properly so called, and it required for every particular case a direct reading of the sky. A cloudy night, however, rendered such direct readings impossible. Now, the Kouyunjik inscriptions, dating from the time of the Assyrian king Assurbanipal, yield evidences for a continuous series of actual observations. From these we learn that, notwithstanding the complexity of the planetary movements, the periodic repetition of essential phenomena had been calculated for each particular planet. Thus the astrologer could fall back upon tabulated records covering every particular sequence of planetary movement, and could substitute these for direct observation. It is true that, owing to trifling inaccuracies in the data thus supplied, this course was avoided for thousands of years; but at length the momentous step was taken. No doubt, it still remained necessary to bring certain recorded positions to the test of actual observation; but, with these exceptions, the researches of the practical astrologer were thenceforth pursued in the study. Our earliest evidences for this procedure date from the period of the Persian monarchy.

So far as astronomy itself is concerned, this was a progressive movement; but, from the standpoint of observational science, it was a backward step. It issued finally in the determination and mathematical calculation of the planetary orbits by Kepler. But, in our estimate of Kepler's discoveries, we must always bear in mind that he was still under the spell of the astrological conception of the universe. It was his firm belief that his discoveries supplied the key to all events of history, and had exalted astrology to the level of a perfect and independent science of simple calculation, while in reality he had given the death-blow to its pretensions.

From the time of the earliest attempts to draw up a calendar—through the period of the Sumerians and Akkadians—to the days of Kepler astrology underwent no essential change, save that it gradually abandoned the method of direct observation of the heavens in favour of, first, a partial use of tables containing earlier observations, and, finally, a purely arithmetical determination of the positions occupied by the planets at any given time. Astrology, be it remembered, was a study of international importance. Wherever, therefore, in the history of any civilized country we can trace some slight advance in astronomical science, we find corresponding records, practically contemporaneous, in all the civilized countries of that epoch. Additions to men's knowledge of the stars were valued only as ancillary to the determination of the planetary positions. As all the available evidence goes to show, however, astrology, throughout its entire career, had but one method of adapting this knowledge to oracular ends—the method, namely, of symbolical interpretation, with a more or less clearly realized principle of alternation. In the main, the positions of the planets were made

the basis of prognostications of the unborn future, but they were also used as a means of filling up *lacunæ* in the knowledge of the past and the present.

10. Astrology and medicine.—In the ancient Oriental view of the world, astrology, religion, and therapeutics went hand in hand. In the conviction that all things in the universe proceeded in parallel lines, men spoke of a macrocosm (primarily the stellar world as the province of Deity) and a microcosm (primarily the human body), and sought for far-reaching analogies between them. Thus—to take one of many examples found in Sanskrit literature—the Vedas and their allied texts exhibit attempts to establish an exact equivalence between the number of the bones in the human body and that of the days in a year. Simple as would have been the task of enumerating the bones accurately, they were purposely numbered wrongly, so that the desired numerical relations might be educed; the lower jaw, for instance, was said to be composed of eighteen single pieces, not including the teeth, just because this number, while purely factitious, could, as the twentieth part of 360, be used for purposes of speculation. The method was applied in every field, and things which did not harmonize in fact were arbitrarily made to do so.

In the ancient East the therapeutic art was based upon the two fundamental postulates of air in motion and liquid in motion, and it was supposed that in the human body the air passed along the arteries, while the liquid traversed the veins. The solid substance of the body (its earthy constituents) and its native heat (its igneous constituents) were regarded as forming a fixed and constant mass: earth and fire, in fact, were probably never considered in their physiological aspects until the Hellenistic period. The astrological references hitherto discovered in Babylonian and Egyptian texts show that air and liquid alone were taken into account. In the further development of these notions, special prominence was given to the air by the pneumatists, and to the blood (*i.e.* liquid, and a mixture of the four principal humours, viz. water, phlegm, yellow bile, and black bile) by the hæmatists. We cannot enter here into the particulars of the antagonism maintained between the two schools for several thousand years, an antagonism which we can trace in the period when the Pyramids were built, and which, again, moved the hæmatist Aristophanes to the mortal hatred wherewith in the *Clouds* he arraigned the pneumatism of Socrates before the Athenian populace. Suffice it to say that, in all references to the facts of nature found in the Pentateuch, the Jahwistic sections (of Genesis in particular) represent the pneumatic, and the Elohistic portions the hæmatic, point of view, whereas the Priestly Code exhibits no scientific tendency at all. The pneumatists regarded the nose as the most important organ of the body. We may recall the numerous phrases formed with אַף in the OT, and the large noses of the singers in the chorus of the *Clouds*. Even amongst the inscriptions from Nineveh, which must, on the whole, be reckoned to the hæmatic school, the present writer has found no fewer than fourteen different texts referring to divination by the nose.

According to the hæmatist, life was concentrated in the liver, the כָּבֵד, or heavy organ, which, accordingly, together with the blood, plays a prominent part in the OT and the Talmud. Among the Babylonians and Etruscans, again, as also among the various peoples influenced by them, haruspicy took the special form of divination by inspection of the liver. The cuneiform texts which treat of this hepatoscopy are without number, and have been read and translated mainly by Jastrow. In the ancient East, and even in Greece, the hæmatists were for the most part firm believers in astrology, omens, and all that we now brand with the name of superstition. To dreams, above all, they attached great importance, while the pneumatists, on the other hand, as is shown by the writings of Hippocrates, declared dreams to be unworthy of consideration. The pneumatists seem to have borne the reputation of being enlightened persons, or sometimes even atheists, as was the case with the pneumatist Socrates as delineated by Aristophanes. From certain fragmentary indications we may perhaps gather that in the main the Christians of the early centuries were pneumatists in their knowledge of nature.

From the mental standpoint of the hæmatic astrologer every actual group of relations amongst the planets mirrored itself in all synchronistic events and conditions, and thus the entire horoscope would be reproduced in the variations and peculiarities found in the liver—the central organ—of the newly-born sacrificial animal. An expert examination of the liver could therefore quite well take the place of a direct observation of the sky. The practice of hepatoscopy was extensively diffused, and diagrams illustrative of the art are still extant. The method adopted by the Babylonians was to portion out the liver in what may be called oracular squares by means of a right-angled system of ordinates, a device reminding us of the square sections shown by the extant Egyptian projection of the heavens made in the time of King Seti, and likewise of the square figure used as the ground-plan of the normal horoscope. Among the Etruscans, however, hepatoscopy employed a polar projection in its construction of oracular fields, and to this arrangement corresponds the system of regular polygons designed to represent the relative positions of the planets in the circular horoscope.

Another way of dispensing with direct observation of the heavens was to watch the forms assumed by certain substances when suddenly placed under new conditions, as it was supposed that the forms thus produced were determined by the configuration of the planets at the time. Oil or melted tallow was dropped into water, or water into oil, and the diviner took note of the resultant forms. We possess two comprehensive lists drawn up in the reign of King Ḫammurabi of Babylon for the express purpose of interpreting these formations. This mode of divination still survives in the superstitious practice of dropping molten lead upon a cold surface.

A further variety of oracle was found in dreams, to which reference has already been made. Dreams also were believed to run parallel to the facts of astrology, and might, therefore, be substituted for the latter. But, as dreams were held to have their origin in the blood, their significance was conceded by the hæmatists only.

Finally, every unaccountable phenomenon of nature—from the movement of an animal to a monstrous birth—everything, in short, that touched human life at any point, came to be associated with planetary influence, and might become the basis of divination. The library of Sardanapalus contains thousands of tablets in which such superstitious ideas and practices are expounded with the most precise casuistry. They seem to have been regarded as the supreme and final expression of wisdom, and might relate to matters a thousand years old. But these fallacious issues of man's search for knowledge, involving such a prodigal expenditure of energy in collecting data, find their ultimate explanation in the fundamental misconception of astrology, viz. that the incidents of life, being dependent upon the contemporaneous con-

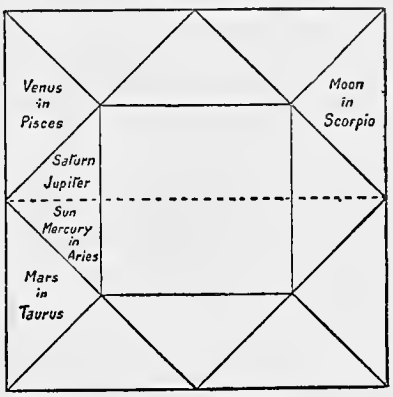
figuration of the planets, must exhibit a parallel order in their occurrence, and that accordingly valid inferences regarding either of the parallel series may be drawn from the other. The underlying conception of the whole procedure, however, was that of the astrologer, and hence we find that in the system of divination by bowls which was practised in the time of Hammurabi, the instantaneous formations of dropped grease were regarded as yielding actual knowledge of the planetary deities.

11. **Subsidiary tables.**—The various substitutes for astrological diagnosis might become, and, indeed, necessarily became, very important, as it was often difficult to determine the requisite facts concerning the planets. We must remember that the problem usually set before the astrologer was to draw the horoscope of the birth or conception of an individual at a time when years had elapsed since these events, and by this means to forecast the future. His task was, in short, to re-construct the astrological conditions of a past event, and he had in consequence to refer to tables or lists of earlier astronomical observations. As regards the sun and the moon, the information he required was furnished by the calendar, but special lists were necessary for the five smaller planets. An extensive table of this kind, written in the Demotic character of Egyptian, and dating from the reign of Augustus, has been preserved. The Julian emperors, let us remember, used to settle their retired soldiers in Egypt. Colonies of veterans thus established in the Fayum would be largely drawn from those who had been born in the reign of Augustus. It was therefore necessary that the astrologer who practised his art in this province should possess lists of the successive positions of the planets during that reign. The example before us is but the transcript of a transcript: whole lines are wanting, and figures have been misread. We may thus infer that such lists were produced in great profusion to meet the needs of astrologers in the various districts and villages. In order to make the proper entries in the horoscope required, the astrologer needed simply to know the zodiacal signs in which the several planets were situated at the time, and accordingly the information supplied by the astrological lists regarding any particular planet was confined to the day of the month on which it entered a new sign. The ancient lists of ephemerides were thus neither more nor less than astrological tables.

For predictions of a general kind the astrologer constructed 'nativities,' while for cases of sickness he drew horoscopes of the *κατάκλισις*, *i.e.* the inception of the disease, and otherwise adapted his art to special circumstances. He had to be informed of the day, month, and year of the critical event. The signs occupied by the smaller planets at the given date were then noted down from lists like that of the Berlin Papyrus 8279; the moon, together with the day indicating its age, was inserted in the proper sign according to the calendar of the lunar cycle, its lunar station being also fixed by established rules; the sun was placed according to the date. The next step was to arrange these particulars systematically in the twelve houses, the exact hour of the event, or, failing that, the time of sunrise, being used as the determining point. From this, again, the positions of the planets relative to one another, to the eastern point, and to the different zodiacal signs, were deduced and interpreted.

12. **The horoscope of Jesus Christ.**—As an illustration we shall take the horoscope of the conception of Jesus, according to the form in which we are able to re-construct it from the Demotic table of the planets in the Berlin P. 8279. The dates given are themselves products of astrological speculation, and cannot be regarded as historically established, but they are nevertheless worthy of notice. On the 24th of June, B.C. 7 (or previously), took place the conception or birth of John the Baptist. On the 15th of April, B.C. 6, 5 a.m., the annunciation to Mary (instead of the conception of Jesus), and, at the same time, the observation of this 'nativity' by the Magi. Between the 24th of June, B.C. 6, and the 25th of November, B.C. 6, occurs the visit of the Magi to King Herod. After the 25th of November, B.C. 6, the Magi notice the re-appearance of the stellar configuration at the annunciation. On the 27th of December, B.C. 6, the stellar configuration becomes stationary (*ἀστὴρ ἔστη*), and the Magi worship the infant at Bethlehem.

Now the horoscope of the 15th of April, B.C. 6, can be re-constructed thus:



and supplies the following apotelesmata capable of interpretation:

(1) The horoscope of the day appears (with sunrise). (2) Aries is in the ascendant. (3) Mars, as lord of the house of Aries, presides over the birth. (4) The sun is in the ascendant. (5) Saturn in the ascendant. (6) Jupiter in the ascendant. (7) Mercury in the ascendant. (8) Saturn in the ascendant, and above the horizon. (9) Saturn is intercepted between the favourable planets Venus and Jupiter. (10) Mars in the second house. (11) The moon enters the eighth house. (12) Venus is in the twelfth house. (13) Mercury in the house of Mars, and likewise in immediate proximity to Mars. (14) Saturn is in his *ταπείνωμα*, or 'detriment.' (15) The sun in his *ὕψωμα*, or 'exaltation.' (16) The moon in her *ταπείνωμα*. (17) Venus in her *ὕψωμα*. (18) Venus is *matutina* (morning star). (19) Jupiter is in proximity to his house Pisces. (20) Jupiter in trine (*adspectus trigonalis*) with his house Sagittarius. (21) The sun in trine with his house Leo. (22) Saturn's motion is direct. (23) Jupiter is direct. (24) Mars is direct. (25) Venus is retrograde. (26) Mercury is direct. (27) Mercury is combust. (28) Mercury in immediate proximity to the sun. (29) Mercury is invisible. (30) Mars is not combust. (31) Mars is nevertheless invisible, and is, in fact, entering upon its invisible period of three months. (32) Mars is separated from the sun by Mercury. (33) Saturn is separated from the sun by Jupiter, though the latter is combust. (34) Jupiter is combust. (35) Jupiter is separated from the sun by small planets. (36) All the morning stars are visible. (37) All the evening stars are invisible. (38) Mars is situated in his nocturnal triangle. (39) The terrestrial triangle contains Mars only, its nocturnal lord, situated in Taurus. (40) Mars is in opposition to his house Scorpio. (41) The moon in trine with her house Cancer. (42) The moon is in her domain. (43) The trigonum of fire contains its lords conjoined in Aries. (44) The trigonum of water contains its diurnal lady Venus. (45) The trigonum of water contains its nocturnal ruler, the moon. (46) The moon and Venus are in trine. (47) The trigonum of air is empty. (48) Saturn and Jupiter are in conjunction. (49) This conjunction occurs in Aries, and is thus *conjunctio maxima*, and dominates the entire horoscope. (50) This *conjunctio maxima* was preceded by a *conjunctio magna*, occurring in Pisces (indicating the astrological necessity for the forerunner, John the Baptist). (51) Saturn is in conjunction with the sun (but cf. 33). (52) Saturn is in conjunction with Mercury. (53) Mars and Mercury are in different houses, but close together. (54) Saturn and Venus are in the same relation. (55) Jupiter is in conjunction with Mercury. (56) Venus is visible. (57) Saturn is visible. (58) Jupiter is visible. (59) Saturn has no aspect with the moon. (60) Saturn is in *adspectus confinis* with Venus. (61) Saturn is in *adspectus confinis* with Mars, but triply intercepted.

(62) Jupiter has no aspect with the moon. (63) Jupiter is in *adspectus confinis* with Venus, but intercepted by Saturn. (64) Jupiter is in *adspectus confinis* with Mars, but doubly intercepted. (65) The sun has no aspect with the moon. (66) The sun is in *adspectus confinis* with Venus, but doubly intercepted. (67) The sun is in *adspectus confinis* with Mars, but intercepted once. (68) Mercury has no aspect with the moon. (69) Mercury is in *adspectus confinis* with Venus, but triply intercepted. (70) Mercury is in *adspectus confinis* with Mars. (71) Mars is in opposition to the moon. (72) Mars is in trine aspect with Venus. (73) Full moon is just past. (74) No planets are in quartile with each other. (75) Of the tropical signs only Aries is occupied, but it contains four planets. (76) All the planets except the moon are clustered near the sun. (77) All the planets except the moon and Venus are under the influence of the sun (Mars as lord of the sun's house). (78) Jupiter emerges from the sun's beams. (79) Hence the *conjunctio maxima* also emerges. (80) All the visible planets and the moon are situated in the diurual sky. (81) All invisible planets are in the nocturnal sky. (82) The lord of Saturn's house is Mars. (83) The lord of Jupiter's house is Mars. (84) The lord of the sun's house is Mars. (85) The lord of Mercury's house is Mars. (86) The lord of Venus's house is Jupiter. (87) The lord of the moon's house is Mars. (88) The lord of the house of Mars is Venus. (89) The horoscope, *i.e.* Aries, is masculine. (90) The other occupied houses are feminine.

Several points of detail may be left out of account. By making the horoscope more precise, and dividing it into decanates and degrees, we might multiply indefinitely the ninety particulars given above. These data of the positions occupied by the planets were known as *apotelesmata*. The ninety *apotelesmata* enumerated here can be interpreted only in part at the present day, as our information regarding ancient modes of astrological interpretation is at best fragmentary. According to rules still extant, interpolations and adjustments, no doubt, have also been made in certain particulars. So far, however, as we can test the interpretations of this horoscope, it corresponds with the evangelical narratives of the life of Jesus even in its smallest details.

13. The development of astronomy and astrology among the various peoples.—The foregoing sketch makes it evident that primitive peoples constructed their calendars by direct observation of the heavens. Similarly, it is amongst these primitive peoples, as indeed we might expect, that we find the first steps of the transition from astronomy to astrology. Thus, in the interior of some of the larger South Sea Islands, as, *e.g.*, Borneo, a primitive astronomy and astrology are found amongst the aborigines, while the inhabitants of the sea board, as also of the smaller islands, exhibit a higher development in the science of the stars, partly because their nautical interests demanded a more thoroughgoing observation of the heaveuly bodies, and partly because they were influenced by the higher standard of culture attained by the Asiatic races, as is shown, for example, by the fact that the Malay language contains words borrowed from Chinese, Sanskrit, Arabic, and Persian. Of the pictorial writing of ancient Mexico, part of the calendar is all that has hitherto been deciphered; but even this suffices to show striking correspondences between the civilizations of America anterior to its discovery by Columbus and those of the ancient Asiatic races, and not least in astronomy and astrology. The development of these sciences already attained in the Babylonian period or later in the time of Alexander the Great is practically the same as now prevails throughout China, in part of Japan, and, above all, in India.

In the West, likewise, the results of astronomical inquiry were still encumbered with the old superstitious conceptions. The earliest successful attempts to eliminate these conceptions and their effects from astronomy were made about A.D. 1500. It is true that at the zenith of Roman civilization the educated classes tried to throw the lumber of astrology overboard. Certain of the Church Fathers wrought strenuously to oust it from its place. But, on the one hand, the vexed question regarding the date of Easter, which was simply a consequence of combining the lunar calendar of Babylon with the solar calendar of Egypt, and, on the other, the attempt to fix a year for the birth of Christ, gave astrology once more a certain adventitious prestige in Christian life and theology. Fresh vantage ground was also won for it in the secular learning of the Middle Ages by the Western drift of Islām and the Jewish Kabbala. As a matter of fact, the astronomy of the West, and, in particular, the coalescence of astronomy and astrology in the later culture of Western lands, is a development or an importation from the astronomy and astrology of the ancient East.

Until the time of Kepler, astronomy was always bound up with astrology, and its progress was for the most part of a meagre kind. This may seem incredible so long as we confine our investigation to a short period abounding in records, but it is always unsafe to argue from the silence of the earlier records that the apparently fresh facts set forth in the later constitute an actual advance. No candid observer in the field of astrology could fail to notice that, while this or that forecast might happen to be correct, yet in many cases the configuration of the planets, however skilfully interpreted, could not be reconciled with the facts of experience. Certain details of astrological procedure were, therefore, constantly being left behind, as in an ever-seething witches' caldron; and, on the other hand, long disused methods were once more resorted to. This was especially the case when, in periods of unrest, races and civilizations were shaken and mingled together. Detailed research in a narrowly circumscribed period may thus produce the illusion of rapid development in a science which, in its leading features, really remained unchanged from age to age.

The fundamental tenets promulgated by astrology as inviolably true were manifold. From the fourth house, as it seemed, welled up the subsoil water and the springs which fed the rivers, while from the tenth house came the rain. Now when primitive man found the moon in either of those houses he anticipated a flood. But the moon was evidently connected also with the occurrence of menstruation, which was regarded as a periodic overflow of blood. The astrological explanations of these phenomena tended to corroborate one another so fully that the sovereignty of the moon over the liquid element was deemed indisputable. An example of a different kind is furnished by the horoscope of disease, or rather of the κατάκλισις. Here the invalid was the querent, and his malady the quesited, and information regarding them was supplied by the first and seventh houses respectively. Now, in the regular horoscope the sixth house was significant of pain and the eighth of death, and thus the entire western section of the sky from 45° above the horizon to 45° below it was the region of disease. In this expanse, however, the sun, distinguished among the planets as the source of heat, is situated between three and nine o'clock p.m., and this again is the time when the invalid shows symptoms of fever. An easy explanation was thus provided for the increase of febrile temperature, while on the other hand the validity of the science was demonstrated once more. Astrology simply abounded in spurious proofs of this type.

Thus the leading principles and ideas of astrology were looked upon for centuries as incontrovertible. Its failures were attributed to points of secondary moment, save in cases where it seemed more convenient to change the time premised by a whole double-hour, and so to shift the entire horoscope by one house—an artifice

which would in general quite invert the first interpretation. Corrections and alterations were thus made in matters of detail, while among the more progressive peoples the general tendency was towards over-refinement in interpretation and an ever-expanding casuistry.

Accordingly there was no real development in the astronomy and astrology of the ancient East within historic times. The extant evidences of the inscriptions go as far back as the period of Šargâni-šar-ali and Narâm-Sin. From the reign of the former eight short texts are all that have as yet been brought to light, and from that of the latter sixteen only, all of the same date. It is not to be expected, therefore, that we shall trace all the details of later astrology in such meagre records. It is surely sufficient for our purpose that the later period, the archives of which may quite well extend backwards to the monarchs just named, yields a mass of evidence to show that astronomy and astrology had by this time reached the status of a closed and rounded system. Inscriptions from the age of Ḫammurabi make it clear that full instructions had already been drawn up for the practice of divination by cups in connexion with planetary configurations. From a period about a thousand years before Christ come the inscribed boundary-stones, the dates of which are indicated by their arrangement of the planetary symbols. Thereafter the richest vein of astrological records is found in the library of Sardanapalus. We learn from these that there was a system of observatories covering the whole kingdom, that there was an established scheme of relays for the professional astrologers and of serial reports regarding their work, and that a State library had been established for the purpose of supplying all needed information in astrology and the auxiliary arts of divination. It is to be regretted that as yet only the *Reports* of the astrologers and the instructions regarding hepatoscopy have been properly edited. The cuneiform texts of the period between Sardanapalus and the beginning of the Christian era are not so rich in relevant information. The astronomical texts of this epoch, however, have found a thoroughly capable editor in Kugler, whose labours were based on the preparatory studies of Strassmaier and Epping, but who, unfortunately, engaged as he was with the productions of a relatively short period, has failed to grasp the subject in its entirety. A final residuum of Babylonian astrology was the perfunctory knowledge of 'the science of the Chaldæans' current in the days of the Roman Empire. From the beginning of our era astrology and astronomy languished on in the various Asiatic countries, but they were borne westwards by the Arabs. Mesopotamia always remained more or less of a *terra incognita* for countries influenced by Græco-Roman civilization.

On the other hand, Egypt became permanently merged in the Roman Empire, and, at a later period, in the Byzantine Empire. It was Egypt, therefore, that brought Babylonian astronomy and astrology into real contact with the West. Even in the most remote times, in a period, it may be, anterior to the First Dynasty, astrology, religion, and medicine were combined as one science at Heliopolis. The high priest of Heliopolis, officially invested with the star-spotted panther's skin, was all along the supreme State astrologer until the imperial age of Rome, and he bore the title of 'great in vision' already alluded to. A hierarch of this order is named in the Bible (Gn 41^{45}) as the father-in-law of Joseph—of that Joseph who was himself an interpreter of dreams ($40^{5ff.}$ etc.), and practised the art of divination by bowls ($44^{5.\ 15}$), referred to in connexion with Ḫammurabi. On the wall of a tomb dating from the reign of Seti I. we find lists of stars, times of culmination, etc. Extensive tables of ephemerides and a fragment of planetary divination according to the different houses, together with corresponding dream-tables, have survived from the age of Augustus. We possess even horoscope-texts drawn up in the Imperial period. Our minor records of later Egyptian astrology are thus fairly numerous.

Græco-Roman civilization throughout its entire geographical and historical range, until the establishment of the world-empire and its swift decline, never produced such monuments as we find in the great empires of the East. Observatories of colossal proportions, attached to primeval temples containing archives by which the positions of the planets might be traced and tested for centuries and millenniums, were never the work of Greece and Rome. Among the Etruscans, therefore, and subsequently among the Romans, it was the surrogates of astrology that occupied the central place. Apuleius explicitly asserts that the Chaldæans were the founders of astronomy and astrology. But, so far as the Romans concerned themselves with the study, they appealed to the works of an assumed Egyptian king called Nachepso and his astrologer Petosiris of Sais. At a later period Claudius Ptolemæus (A.D. 100–178) was regarded as the final authority in our twin sciences, and beside him we catch a glimpse of the somewhat legendary Hermes Trismegistos. But, as has been already indicated, the claims of astrology were not left unchallenged in this period. About the year A.D. 200 the famous physician Sextus Empiricus wrote a work in six books *πρὸς μαθηματικούς*, of which the fifth was directed *πρὸς ἀστρολόγους*. He prefaces his confutation by a sketch of the entire system of knowledge possessed by the *Χαλδαῖοι*, and in this he provides valuable materials for a thoroughgoing digest of the astrological texts in the library of Sardanapalus.

In this later period, however, astrology has maintained some degree of progress in the Far East. Among the Chinese and Japanese, occult art, in the modern 'fengshui,' seems rather to have taken the form of geomancy. Just as in the Near East astrology gave birth to hepatoscopy, so in China and Japan the interpretation of the planets in the celestial vault has been transformed into divination by the carapace of the tortoise. Similarly the Gypsies have developed a system of fortune-telling from the open hand; and the designation of the convexities of the palm as 'mounts' of the various planets shows us that this practice also is a surrogate of astrology.

LITERATURE.—The significance of astronomy and astrology for the interpretation of the religious conceptions of the ancient East, as also for the exegesis of the Bible, has only recently been recognized. There is as yet no comprehensive work dealing with the subject. Contributions to the study have come mainly from the hand of H. Winckler (especially in *Im Kampfe um den alten Orient*, Leipzig, 1907), of whom A. Jeremias (*Die Panbabylonisten, der alte Orient und die aegyptische Religion*, Leipzig, 1907) has proved an able ally. Fugitive essays have appeared in considerable numbers, principally in publications of the *Vorderasiatische Gesellschaft* and the *Orientalistische Literaturzeitung*; Hinrichs (Leipzig) has also issued a number. At first the new exegetical theory encountered very strong opposition, but afterwards seemed to have won a general assent; more recently, however, the work of Kugler, already referred to and appraised, has given it a partial reverse. K. Sudhoff (*Iatromathematiker, vornemlich im 15. und 16. Jahrhundert*, Breslau, 1902) and the present writer, starting from the history of medicine, have studied the ancient astronomy and astrology, and have arrived at the same results as Winckler, though by a very different path. The present writer has also written numerous essays on the subject, and these have appeared in various periodicals, medical, philological, and theological, esp. *Die Angaben der Berliner Planetentafel*, p. 8279, Berlin, 1903, *Das Horoscop der Empfängnis Christi*, do. 1903. These publications are based upon cuneiform and hieroglyphic (or demotic) texts which have only recently become accessible.

The leading work for the discovery of the relevant cuneiform texts is C. Bezold, *Catalogue of the Cuneiform Tablets in the Kouyunjik Collection of the British Museum*, 5 vols. The shorter texts are to some extent accessible in Thompson, *Reports of the Magicians and Astronomers of Nineveh and Babylon* (1900). Outgrowths of Oriental astronomy and astrology are found in the writings of Claudius Ptolemæus, Claudius Valens, Paulus Alexandrinus, Julius Firmicus Maternus, and Marcus Manilius, and also in the works of opponents, such as Sextus Empiricus, Cicero (*de Divinatione*), Horace, Juvenal, Pliny, and, in the 15th and 16th cents., Hieronymus Cardanus and Pico de Mirandola. Boll, *Sphæra*, is a modern comprehensive work dealing with classical astrology and astronomy, but the author had not the requisite data for a corresponding treatment of the ancient East. The latest cuneiform texts from the period of the Persian kings and the Seljūks have been utilized by Kugler in vol. i. of a work to be completed in 5 vols. E. Stucken, *Astralmythen* (Leipzig, 1907), admirably depicts the process by which the myths and legends of the various races of mankind grow out of the same original astrological conceptions, and arranges the stupendous mass of materials according to their affinities with the Biblical narratives regarding Abraham, Lot, Jacob, Esau, and Moses. A short manual of astrology by Ernst Mayer, entitled *Kurzes Handbuch der Astrologie*, and giving technical information about the placing of the horoscope, was published by Dekker (Berlin, 1891). A vast aggregation of data relating to the vestiges of astrology in Asia and the South Seas may be gleaned from the *Mittheilungen der deutschen Gesellschaft für Natur- und Völkerkunde Ostasiens*, in *Der Janus* (*Archiv für Gesch. der Medicin*), and in the publications of Sanskrit scholars. The attempt to furnish a more detailed bibliography than the present is always confronted with the difficulty of knowing which of the manifold ramifications of our subject the reader is interested in. In one or other of the leading works here cited, however, the student will find a more complete list of works relating to the particular field of inquiry with which he is concerned.

F. VON OEFELE.

SUN, MOON, AND STARS (Primitive).—Knowledge of the movements of the heavenly bodies is possessed in varying degrees by most primitive peoples. In the earlier stages of civilization that continued observation which is necessary to arrive at a reasoned explanation, which is the foundation of astronomical science, is not possible through lack of proper means of recording its results, nor is it called for by the practical requirements of a population which lives chiefly by hunting. For an agricultural people, however, foreknowledge of the recurring seasons becomes essential, and it is necessary that some means should be found to mark the proper seasons for performing the operations to ensure the food supply. In the stars, with their regular motions of rising and setting, primitive man has found the earliest and most convenient calendar. In default of a theory based upon a series of observations, the supposed movement of the sun round the earth, the phases of the moon and the motion of the stars, the shape and character of the sky, have been explained by formulæ composed of material drawn from the texture of man's religious beliefs. The celestial bodies, equally with his fellows and material surroundings, he considers to be animated with a personality like his own, though more powerful. Starting from this fundamental assumption, primitive man has fashioned for himself, in his legends, a fairly complete explanation of the celestial phenomena which come under his observation.

1. **Sun and moon.**—It is almost universal among primitive races that both sun and moon should be regarded as alive and quasi-human in nature. Their sex differs among different races, but the moon is more commonly male and the sun female. Relation between them, varying in character, is also recognized. Among the Dieri of Australia the sun is the daughter of a Dieri woman, who after her birth sank into the earth in shame. The natives of Encounter Bay say that the sun is a woman who has a lover among the dead. Each night she descends among the dead. At her rising she appears in a red kangaroo skin, given her by her lover. A Wotjobaluk legend relates that the sun is a woman who was digging yams and reached the West; after wandering round the earth she came back to the other side, and has done the same ever since. The Wurunjerri say that the sun is the sister of every one. This may be compared with the story of the origin of the sun told by the Arunta. At Alice Springs there is a tradition that in the Alcheringa the sun came out of the earth at a spot now marked by a stone in the country of the Bandicoot people, in the form of a spirit woman, accompanied by two other Panunga women, who were sisters, the elder of whom carried a child. The spirit woman went up into the sky, and she does this every day, visiting the old spot at night and rising in the morning. A medicine-man could see her in the hole, but not a person with ordinary vision. The two women settled among the Bandicoot people, and originated a local sun totem. This totem may be compared with the sun totem of the Incas. The sun has a definite relation to each individual member of the various divisions, belonging itself to the Panunga division, as did the two women. Among these people a ceremony connected with the woman and the child is performed, in which symbols of the sun are worn.

The Masai say that the sun married the moon, and they had a fight. Each damaged the other. The sun was so ashamed that he became bright, in order that people might not be able to look at him. The moon was not ashamed, and it is possible to see that her mouth is damaged and that one eye is missing.

It is interesting to note that, while the sun is a man and the moon a woman, the Masai word for sun, *eng-oloñg*, is feminine, and *ol-apa*, 'the moon,' is masculine. The Bushman story goes that the sun was an old man, from whose armpit light radiated; some children threw him up in the sky, where he stuck.

Occasionally both sun and moon are feminine. Among the Mantras the sun is a woman, who is continually being pulled by a string held by her lord. The moon is a woman, the wife of Moyang Bertang, who sits in the moon making nooses for men.

(*a*) *Origin and movements of the sun.*—The origin of the sun, as related in the Tembeh legend of Sam-mor and his battle with Naing, has advanced beyond the anthropomorphic stage. When Sammor had imprisoned Naing, he rolled the fire with which he had fought into a ball, and this, as the sun, still revolves round the mountain to watch Naing. This conception of the sun as inanimate is probably due to external influence, but it has a parallel among the Gallinomeros of Central California, where the hawk and the coyote, after jostling one another painfully in the darkness which then prevailed, collected two masses of inflammable substance; the hawk then flew up into the sky with them, and lighted them with flint. They give light as the sun and the moon. The Wurunjerri believe that the sun was made by Puppu-imbul, one of the race inhabiting the earth while everything was dark. This personage, it is hardly necessary to point out, belongs to the race of demiurges of which Prometheus is the type.

The sun did not always cross the sky in the same leisurely manner as at present. The great feat of Maui, the Maori hero, was that he tamed the sun. According to one version, he beat him so unmercifully that he lamed him, and he has walked slowly ever since. In Samoa the sun had a child by a Samoan woman, who trapped the sun by a rope made of vine. Another Samoan lassoed the sun, and made him promise to go slowly. The same or an analogous explanation is found in Aztec folk-lore and in North America. On the other hand, in Australia and in Melanesia the sun did not set. In the myth of the aborigines of Victoria, Norralie decided that the sun should disappear at intervals, and addressed it in an incantation, 'Sun,

sun, burn your wood, burn your internal substance, and go down.' The sun now burns his fuel in a day, and goes below for fresh firewood (R. Brough Smyth, *Aborigines of Victoria*, iv. 430). In Melanesia Qat (the Melanesian hero) went to Qong ('night') and begged assistance. The latter put him to sleep, and, in twelve hours or so, crept up from the horizon and sent the sun crawling to the West (Codrington, *JAI*, Feb. 1881). In a Brazilian myth, a man ('the great serpent') who owned night sent it in a gourd to his daughter on her marriage; the messengers opened the gourd and let it out.

Various explanations are given of the sunset. The simplest is that the sun sinks into a hole, occasionally the hole from which he arose. The Dieri say it sinks into a hole near Lake Eyre, and in the night travels underground to the East, in the same manner as it was believed to do in ancient Egyptian belief. Not infrequently the sunset myth takes the form of a legend of a personal hero plunging into the body of a personal night. Maui was caught in the mouth of Hine-nui-te-po, 'Great Daughter of Night,' and thus brought darkness and death into the world. Since then the sun descends into the under world, and repeats the battle with Hine-nui-te-po every night. An explanation of sunset is that Maui took fire, and when it burnt him he plunged into the sea. Among the Basutos, all men but Litaolane were devoured by a monster. He also was swallowed, but cut his way out. The Zulu story of the rescue of Princess Utombende is of a similar character.

(*b*) *Origin and movements of the moon.*—The moon occupies a prominent place in primitive folklore for which her periodical growth, diminution, and disappearance, phases more marked than those of the sun, may not unreasonably be held to be responsible. Like the sun, the moon is regarded as a living person. Allusion has already been made to the variation in the attribution of sex to the moon among different peoples. One or two further instances which illustrate other points of lunar mythology may be added. Among the Aruntas the moon is a big man (*etwa oknurcha*). They say that, when there was no moon in the sky, a man died and rose again as a boy. The people ran away. He said, 'Do not run away or you will die. I shall die, but will rise again in the sky.' He grew up and died, reappearing as the moon. Since then he dies periodically. When he is not visible, he goes away to his two wives who live in the west. A second legend of the origin of the moon, which is found among the same tribes, relates that the moon was carried by a blackfellow in the hollow of his shield, who hid it in a cleft of the rocks during the day. Once it was stolen from his shield while lying on the ground. He pursued the robber but could not catch him, so he shouted that the moon should go up into the sky and give light to the people during the night. In South-East Victoria in one myth the moon is an old man who climbed a tree to pick grubs. His sons made the tree grow to the sky, where he became the moon. The Dieri say that there was once no moon; the old men held a council, and a *mura-mura* gave them a moon in order that they might know when to hold their ceremonies. The same reason for the moon's existence is given among the Todas.

The marks on the face of the moon are explained in various ways. The Eskimos say that these marks are the ashes which were smeared on his face by his sister the sun, when he tried to embrace her. Among the Besisi it is said that their chief ancestor Gaffer Engkoh once fell to earth and climbed back to the moon by means of a festoon which he plaited. His comrade Porang Aliyan ascended with Engkoh, but the latter slipped back quickly, taking his rope with him. Porang now dwells in the moon, protecting the souls of the dead who visit the moon from wild beasts. The Mantras believe the dark spots on the moon to be a tree. The Malays see in the moon a banyan tree, under which sits a hunchback plaiting a fishing line. When the line is finished, he will fish up everything on earth, but a rat always gnaws away the line. This belief also occurs in Sumatra. The Malays also say 'the moon is great with a mouse deer,' a belief possibly derived from the Sanskrit idea of the hare which was taken up into the moon for protection. In Mexico it was said that a god smote the moon in the face with a rabbit (Sahagun, viii. 2); in Zululand and Tibet a hare was translated to the moon. The connexion between the hare and the moon is also found among the Namaquas of South Africa. The hare was sent to men to confer upon them a return to life after death, but by a mistake in the message made them mortal. In Fiji the same point of human mortality was argued between the moon and the rat. The latter prevailed.

The Wotjobaluk also connect the moon with a resurrection after death. When all animals were men and women, the moon used to say, 'You up again,' and the dead came to life. An old man said, 'Let them remain dead'; none then came to life except the moon. The connexion is obviously suggested by the necessity for finding an explanation of the phases of the moon. Various explanations are current. The Masai say that the sun carries the moon in his arms when she is tired. After carrying her for two days, he leaves her in his setting-place. On the fourth day she is visible to donkeys. On the fifth day men and cattle see her again. The Wiimbaio say that the moon did not die periodically until so ordered by Nurelli. The natives of Encounter Bay held that the moon was a dissipated woman who spent her time among the men, but when she wasted away they drove her out. While she is in seclusion she feeds upon nourishing roots and becomes plump again (Brough Smyth, *op. cit.* i. 432).

(*c*) *Eclipses.*—An eclipse, whether of the sun or of the moon, is at all times regarded with dread; it is almost universally believed, at the early stages at least, to be caused by a monster who devours, or attempts to devour, the luminary. See art. PRODIGIES AND PORTENTS, vol. x. p. 368 f.

2. **Stars.**—The belief that the stars are great men and divinities translated to the heavens occurs among nearly every people in the world. Stars are grouped together in constellations which represent persons, many of them large, sometimes including one or more of the constellations of our astronomy. The inhabitants of Torres Straits include in their constellation Tagai—a hero who stands at the head of a canoe holding a spear and a bunch of fruit—the Southern Cross, Scorpio, Sagittarius, Corvus, and stars of Lupus and Centaurus. The 'Shark' includes the Great Bear and Arcturus and Gemma. In New Zealand Orion's Belt is Maui's Elbow, while the Southern Cross is identified with the stern of the canoe of Tamarete. Among the Wurunjerri of Australia α and β Crucis and α and β Centauri and other stars are the sons of Bunjil, the latter himself being Altair. Two stars on either side of him are his wives, who belong to the black swan totem, while his brother Nurong and his wives are Antares and adjacent stars. Bunjil and his sons were translated to the sky in a whirlwind. The whole group is intimately connected with the totemic system, Bunjil or Pund-jel being an Australian demiurge. At Alice Springs in Australia the Aruntas say the Evening Star is a woman who went into the earth at a spot marked by a white stone at Temple Bar in the Macdonnell Range, leaving her *churinga* behind. Every child

conceived at this stone belongs to the Evening Star totem, although it is in the lizard totem country, and any child conceived *near* the stone is a lizard. Orion's Belt is said to be a group of young men dancing corroboree. Jupiter, the 'foot of day' (Ginabong-Bearp), was a chief among the old spirits, a race translated before the appearance of man. Among the Eskimos of Greenland, Orion's Belt is 'the Lost Ones,' a number of seal hunters who lost their way home. The Pleiades, an extremely important group of stars for primitive peoples, were known to the Indians of North America as 'the Dancers,' to the Lapps as a company of virgins, and to the Australians as a group of girls playing corroboree. The Aruntas believed them to be women who went up into the sky and have remained there ever since. A legend of the Wurunjerri runs that, when some young women were digging yams, the crow stole their yam sticks. They were swept into the air, when Bellin-Bellin let the whirlwind out of the bag, and the stars are the fire on the end of their yam sticks. Another version says that the group is Bunjil's daughter and two men who were turned into women by Bunjil's son, each receiving yam sticks from Bunjil's daughter. The almost unvarying association of the Pleiades with women among different races is remarkable. It thus appears that the legends which attribute an heroic and human origin to the stars and constellations contain the germs of conceptions which have been utilized by modern astronomy in mapping out the heavens.

Stars, however, are not always translated human, divine, and 'semi'-divine beings. Allusion has already been made to the Malay and Sakai belief that stars are clefts in a superincumbent rock. Take-mahuta, in the Polynesian story, after separating his father and his mother, stuck stars all over his father's body. Maui, after slaying his sons, placed an eye of each in the heaven as the morning and evening star respectively—a story which represents a transition stage between the two groups of animate and inanimate origin.

It is not surprising to find the stars regarded as the moon's children. The Mantras say that once the sun and moon, who were both women, had many children, the stars. They agreed to devour them. While the sun did as agreed, the moon hid her children, producing them afterwards. The sun, being very angry, now pursues the moon but cannot catch her, though sometimes she succeeds in biting her, causing an eclipse. The same story is told by the Hos of Chota Nāgpur. In this story, however, the sun threw a hatchet at the moon and cut her in two.

For practical purposes among most primitive peoples the stars perform a more important function than the sun. By their rising and setting the times of the feasts and ceremonies are determined, and among agricultural peoples their movements serve as a calendar by which the various operations in cultivating the soil are regulated. In the Torres Straits, Tagai marks the time for new yams and the migrations of turtle; Seg, the time for another kind of yam. The Murray Islanders also use Tagai as a mark in navigation. The rising of the constellation Dorgai, which coincides with the North-West Monsoon, is the time to 'make dance.' The natives of Borneo, especially the Dayaks, watch for the Pleiades to determine when to prepare their ground for planting. When it is estimated that the wet season is approaching, men are sent to the forest to watch for the rising of the Pleiades. The Kenyahs and Kayans of Borneo measure the length of the sun's shadow by means of a marked stick with the same object (C. Hose, *JRAS*, Straits Branch, Jan. 1905). The importance of such observation of sidereal phenomena is evident when it is remembered that in tropical regions the seasons bring little or no sign of change to serve as the farmer's calendar. The Masai recognize that the rainy season is approaching when they see the Pleiades, while in the Society Islands the year is divided into two halves, *Matari-i-iniu* and *Matari-i-raro* according as this constellation is visible above the horizon after sunset or not. In fact, over nearly the whole world the rising of the Pleiades is the beginning of the year or a cycle, marks the time for feasts, and is an occasion of ceremonial observance. It may be recalled in passing that Penrose found that the Hecatompedon and the old Erechtheum had been ascribed to the heliacal rising of the Pleiades on May day; and in Britain, it is suggested, while Stonehenge appears to have been built in relation to the rising of the sun at the summer solstice, the 'Hurlers' in Cornwall on *prima facie* evidence seem to have been built in relation to the heliacal rising of the Pleiades on May morning B.C. 1600 approximately.

In some cases the use of the stars as a calendar is not immediately obvious, but is a matter of interpretation. In Australia, Yuree and Wanjel (Castor and Pollux) pursue the Kangaroo (Capella) and kill him at the beginning of the great heat, and the mirage is the smoke of the fire they roast him by. Marpean-Kurrk and Neilloan (Arcturus and Lyra) discovered the ant-pupa and the eggs of the loan bird and taught the aborigines to use them for food. As Tylor points out, these legends and their analogues may fairly be interpreted as indicating the seasons when the pupa and eggs may be found, the great heat expected, and so forth.

3. **Signs and omens.** — The train of thought underlying primitive astronomical theory would seem peculiarly adapted to foster the magical conceptions and analogies upon which astrological reasoning is based. Omens and signs, favourable and unfavourable, are and have always been the object of constant observation in the past of savage and semi-civilized people. It is, therefore, not surprising that peculiar powers in controlling human events should be attributed to those heavenly bodies which are regarded as endowed with powers similar to but greater than those possessed by human beings. Even when a stage has been reached at which the magic powers of the witch no longer gain credence, belief in the power of the moon or the first star of the evening to grant a wish remains as evidence of a time when the favour of the heavenly bodies was essential to success. Lacking the knowledge necessary for the pseudo-scientific cartography of astrology, primitive races never attained the heights of judicial astrology. Yet the belief that, for instance, a child born under Leo would possess qualities usually associated with a lion is one with which a savage would find himself in full sympathy. The Malays possess an elaborate system by which the year is mapped out into lucky and unlucky periods depending upon a rotation of days, each associated with deities, planets, and lucky and unlucky colours, and are acquainted with the use of the magic squares. But their astrological science has been borrowed from the Hindus and Arabs. In the case of races which may truly be described as primitive, the germ of the science rather than the science itself is found, while vestigial traces of these primitive beliefs linger in the popular folk-lore of civilized countries. The belief that the weather changes with the phases of the moon is found among the Ewe peoples of West Africa, where a certain number of days' rain is said to accompany each of the four changes of the moon. At these times they are forbidden to take purgatives, and children and cattle are born. At the rising of Ezā (Orion) rain

falls for seven days in accordance with the number of stars in the group; three days' rain follows the rising of the group Atielo, while the star Toro is peculiarly favourable to huntsmen, who call this time *Ladorgbe*, 'animal chop grass' (P. Fr. Müller, 'Folkloristische Ewhetexte' (Gē-Dialekt), *Globus*, lxxix. Jan. 17, 1901). These beliefs, however, may be regarded as generalizations from imperfect data assisted by magic, rather than as originating in a magical connexion. A less doubtful case of intimate relation between celestial and terrestrial phenomena occurs in the widely distributed belief, still common in European folk-lore, that fertility of crops and success in an enterprise depend on an action undertaken under a waning moon. The Lithuanians wean boys on a waxing, and girls on a waning moon, believing that in the one case it provides strength, in the other, slenderness and grace.

An instance of a belief which most nearly approaches judicial astrology is quoted by Tylor (*Prim. Cult.*[4] i. 129) from Shortland. The Maoris when besieging a 'pa' believed that the result could be foretold by the relative position of Venus and the moon; if the planet were above the moon, the foe would conquer; if below, the home force would be victorious.

LITERATURE.—No comprehensive study of *primitive* astronomy on scientific lines has been made; reference to astronomical legends and a few identifications of stars known to the natives will be found scattered in works dealing with individual races. General principles of study will be found in E. B. Tylor, *Prim. Cult.*[4] 2 vols., 1904, and A. Lang, *Myth, Rit. and Relig.* 1899. See also Sir N. Lockyer, *Dawn of Astronomy*, 1894. For ceremonies connected with the Pleiades see R. Andree in *Globus*, lxiv. no. 22. Instances here quoted are taken chiefly from W. W. Skeat, *Malay Magic*, 1900; Skeat-Blagden, *Pagan Races of the Malay Peninsula*, 1906; A. W. Howitt, *Nat. Tr. of S.E. Aust.*, 1906; Spencer-Gillen, *Nat. Tr. of Cent. Aust.*, 1898; A. C. Haddon, *Head Hunters*, 1901; A. C. Hollis, *The Masai*, 1905; Sir G. Grey, *Polynesian Mythology*, 1855.

E. N. FALLAIZE.

SUN, MOON, AND STARS (American).—

1. Sources.—A large part of our knowledge of the astrology and astronomy of the American Indians is derived from their traditions as reported by early European and American missionaries and travellers. These writers had the advantage of contact with the various tribes before European influence had extensively modified their modes of thought, but they paid little attention to astronomical traditions. The few constellations mentioned by them are seldom identified, and the identifications are frequently indefinite or incorrect. A number of works by native authors give tribal tradition in authentic form, but little astronomy.

In Mexico and Yucatan a few codices, which escaped destruction at the hands of the Spanish priests, contain many complex astronomical symbols of which little is definitely known as yet, but from which, undoubtedly, much will eventually be learned. They are supplemented by hieroglyphs on structures and monuments. In Guatemala there is the *Popol Vuh*, or 'Book of the People' (ed. and tr. Brasseur de Bourbourg, Paris, 1861), and in Peru Salcamayhua's Spanish account of Aymara Quichua antiquities (tr. Markham, Hakluyt Society, 1873). These manuscripts either are of pre-Columbian origin or present pre-Columbian material with slight European modifications. They include some myths and legends having an astronomical basis (cf. also Brinton, *Annals of the Cakchiquels*, Philadelphia, 1885; and *Tres relaciones de antigüedades peruanas*, ed. Ximenez de la Espada, Madrid, 1879). Until recently even scientific travellers have often shown indifference towards astronomical traditions, but ethnologists now recognize the importance of this subject and are collecting material which, in spite of the long contact between Indians and Europeans, affords sufficient evidence of native origin.

In North America these traditions are supplemented by a few valuable star charts. Three have recently been collected amongst the Osages, Pawnees, and Huichols (Dorsey, in *9 RBEW*, p. 378; *Field Columbian Museum Report*, xi. pl. 72; Lumholtz, in *Memoirs of the American Museum of Natural History*, iii. 57 ff.). The two first are intimately associated with the ritual of the tribal secret societies. The Osage chart represents the Hyades, Pleiades, morning and evening stars, sun and moon, and probably the Milky Way and part of Scorpio. The Pawnee chart shows the Pole Star, Great and Little Bear, Northern Crown, Orion, Hyades, Pleiades, Milky Way, and probably Capella; that of the Huichols depicts as stars or constellations the Scorpion (Scorpio) and its Heart (Antares), the Deer (Taurus?), which is pursued by the Dog, a Woman bearing a child, the Crab, Beehive, Humming Bird, and other objects. The winter counts of the Western tribes represented each year by some important event, which is pictured upon a buffalo hide. Naturally they include astronomical figures. That of Lone Dog, for example, presents the meteoric shower of 1833, a comet, and a solar eclipse. The altars of Pueblo secret societies furnish numerous stellar symbols, as is shown by the researches of Cushing and Fewkes in *RBEW*, *JAFL*, and *Amer. Anthropologist*. Tablets inscribed with astronomical characters have been found at Rockford, Illinois, Mitchell Co., North Carolina, and in Missouri. Excepting the rayed solar face, crescent moon, and morning and evening stars, the characters upon these tablets have not been satisfactorily deciphered.[1]

The Mexican calendar stones present another and an elaborate source of astronomical symbolism, to which considerable study has been directed (see CALENDAR [Mexican]). Inscribed stones of astronomical significance have also been found in the Chibcha region of Colombia. The symbols seem to correspond with those ascribed to the Chibcha calendar and constellations by Duquesne (cf. Bollaert, *Antiquarian Researches*, London, 1860; also Humboldt, *Researches*, and Lemly, in *Century Mag.*, 1891, p. 885). A circular gold 'zodiac' from Cuzco presents a solar rayed face surrounded by twelve unknown symbols (Bollaert, *op. cit.* p. 146; Markham, *Cuzco and Lima*, London, 1856, pp. 107–108; Winsor, *Critical and Narrative History of America*, Boston, 1884–1889, i. 235). A wooden box from the west coast of South America figured by Kingsborough (*Mexican Antiquities*, London, 1831, iv.) presents Peruvian symbols of the sun and moon, Orion, Taurus, the Pleiades, and other constellations, but they are associated with symbols of European origin.

A most valuable source of astronomical knowledge is the Peruvian star chart of Salcamayhua, a pure-blooded Aymara of the ruling class, who wrote during the first quarter of the 17th century. With the exception of a prudential reference to the symbol of the Southern Cross, this chart presents only native concepts. It gives symbols of the sun and moon, morning and evening stars, southern pole, Coal Sack, Milky Way, and all the zodiacal asterisms (cf. Hagar, in *Compte Rendu du Congrès international des Américanistes*, Paris, 1900, p. 271 ff.).

2. Scientific knowledge.—The use of gnomons, natural and artificial, was wide-spread in America. Amongst many of the tribes there are still old men who delight in determining the seasons and the time of day by the position and direction of the solar shadows. The Pueblos have measured and named the sunrise points on the eastern horizon so as to divide the year into two periods of six months, and the time of the equinox is determined with great care. The Zuñis used as a gnomon an erect sandstone slab adorned with a solar effigy (Dellenbaugh, *North Americans of Yesterday*, New York, 1901, pp. 305–306; Fewkes, *Annual Ceremonies at Walpi*, Leyden, 1895).

At Chapultepec, in 1775, a stone was found under which three crossed arrows pointed accurately to the equinoctial and solstitial sunrise points (Bollaert, in *Memoirs of the Anthropological Society of London*, i. 210 ff.). The main doorway of the chief temple of Cuzco fronted the north-east, so that at the June solstice the rays of the rising sun would penetrate into the temple and illumine the solar plate at the opposite end, thus recalling the temples of Egypt and Greece; and the early Christian cathedrals oriented to the sunrise point on the day of the saint to whom they were dedicated. It is not unlikely that the orientation of Mexican and Peruvian structures will enable future investigators to determine the dates of their construction by means of the method so brilliantly pursued by Lockyer in Egypt and Penrose in Greece (Lockyer, *Dawn of Astronomy*, London, 1894). Beebe has shown that the monolithic gateway and a large stone platform at Tiahuanaco probably served as a solar dial. The

[1] See *Proceedings of Davenport Acad. of Sciences*; J. P. McLean, *The Mound Builders*, Cincinnati, 1879, p. 118; Short, *North Americans of Antiquity*, New York, 1880, p. 38. W. S. Beebe, who made a special study of the Davenport and Piqua tablets, attempted a full explanation of both. He makes the former wholly and the latter partly astronomical, but his interpretation of the latter stands little chance of acceptance in the present stage of our knowledge. A copy of his privately printed notes is deposited in the Davenport Academy, Davenport, Iowa. One is in the author's possession.

sides of the pyramids of Mexico and Central America are often aligned to the cardinal points. In Mexico, Nobel describes a perpendicular shaft in the pyramid of Xochicalco which permitted the rays of the zenith sun to fall upon an altar in an interior chamber. The shadows cast by the steps of the pyramid of Papantla were observed for calendar purposes (Humboldt, *Researchcs*, ii. 87), and tradition indicates a similar use of the steps and platforms at Cuzco known as the 'Monkeys' Dance.' Mrs. Zelia Nuttall, moreover (*Boas Anniversary Volume*, New York, 1906, pp. 290–299), points out various pictographs in the Mexican codices which represent priests observing the stars to determine the time. The different divisions of time were marked by the sounding of drums or trumpets in the temples. The priests used various methods to fix the position of the asterisms. They observed them through the doorway of the temple, which was elevated above the surrounding country, sometimes placing forked or bifurcated sticks within the doorway to define the position more exactly, and sometimes using a peculiar figure representing the drawn-up limbs of a seated man for the same purpose. A possible use of rows of upright sticks is also indicated.

The Peruvians are also said to have noted the solstices and equinoxes by means of the shadows cast by certain columns. Those on the equator were held most sacred, because at the equinox they cast no shadow (Garcilasso de la Vega, *Commentarios reales de los Incas*, vi. 22). These columns have never been found, but circular stone sun-dials, called *intihuatana*, 'the sun tied up,' exist on the Carmenca hill at Cuzco, where the 'columns' are said to have stood, and elsewhere. A shadow is cast thereon by a small erect stone, which, Squier suggests, may rightly have been known as the *inti rucana*, or 'sun-finger.'

Alleged telescopic tubes have been found in the mounds of the United States and in Peru (Bollaert, *op. cit.* pp. 213, 276; du Gourcq, in *Popular Science Monthly*, xlv. 832), but were probably used by the physicians, who in the latter country were expert in sucking poison from wounds and diseased tissues. The Mexican astronomers, however, seem to have employed obsidian mirrors in their observations (Nuttall, 'Fundamental Principles of New and Old World Civilization,' in *Peabody Museum Publications*, ii., Cambridge, Mass., 1901).

The more advanced American nations, such as the Mayas and Aztecs of Mexico, and the Aymaras and Quichuas of Peru, seem to have attained an astronomical knowledge nearly, if not fully, equal to that of any people prior to the invention of telescopes; they had learnt all that could be learnt by the unaided eye. Their principal practical incentive to stellar observation was the accurate determination of seed-time and harvest, this being elaborated into a calendar. They do not seem to have attained to the heliocentric system, but they knew the cause of the lunar phases, and distinguished the five brighter planets. The Mexicans estimated their synodic periods accurately, and the Peruvians observed the sun-spots (Humboldt, *Vues des Cordillères*, ii. 302, *Researches*, ii. 173; Salcamayhua, *op. cit.* p. 131; du Gourcq, *op. cit.* p. 825), large spots being sometimes visible to the naked eye through the mist or light cloud (*garua*) which is of common occurrence in Peru. In some myths the sun and other celestial bodies, and even the earth, are represented as balls or globes. This does not necessarily imply either European influence or exact knowledge. It may be an analogy derived from the supposed hollow ball of the sky.

3. Astrology.—A system of astrology was undoubtedly in vogue in America. The *Tonalamatl*, or book of lucky and unlucky days, included in the Mexican codices, indicates the propitious and unpropitious times for performing certain actions. In the Codex Vaticanus a human figure appears surrounded by the day signs, which have also zodiacal associations. The commentator says that the influence of month signs upon the moment of birth was an established belief.

'The Mexicans,' says Sahagun (*Historia general de las cosas de Nueva España*, iv. Introd.), 'take much care to know the day and hour of birth of each person in order to conjecture his destiny, life, and death, but they do not base their prognostications upon the positions of the stars.' Nevertheless, the stars warn a god that he must go away in five years (H. Phillips, jun., in *Proc. of American Philosophical Soc.* xxi. 617 f. [Philadelphia]). In Guatemala diviners were called upon to determine the propitious date for each monthly festival. As soon as a child was born, it was brought before the diviner, who, observing the day of birth, told what the child would be and what disposition it would show. He announced these things after consulting a book which contained the month and day signs (Ximenez, *Las Historias del origen de los Indios de Guatemala*, Vienna, 1857, pp. 158–160). In Peru one class of priests devoted themselves to divination by observation of the stars, and the chief priest dwelt away from the Inca capital that he might observe them and meditate more freely upon them. In the solitude of the mountain deserts lived priests who contemplated and adored the stars 'almost without ceasing.' People visited them to learn about lost articles, absent friends, and future events. Even the wild tribes of Eastern Peru regard some constellations as propitious to man, others as hostile (Lorente, *Hist. del Peru*, Lima, 1860, p. 229; Markham, *Cuzco and Lima*; von Tschudi, *Travels in Peru*, New York, 1854, p. 288; 'Relacion anonima,' in *Tres relaciones de antigüedades peruanas*, pp. 157, 164, 178).

It is said that the coming of the Spaniards had been predicted many times by these observations. Atahualpa's general is quoted as saying to his ruler just before the arrival of the Spaniards became known: 'My lord, I watched the stars last night, and saw in them the presage of a great calamity.' Later, Atahualpa himself declared that the appearance of a comet in the Sword of Perseus presaged the death of a man of high rank, and that a similar sign had been seen in the skies a short time before the death of his father, Huayna Ccapac. He was murdered soon after. A diviner, by observing the appearance of the moon, is said to have foretold to Huayna Ccapac the civil war between his sons and the destruction of the Inca rule. Comets and a thunderbolt which fell upon that Inca's Cuzco palace occasioned analogous predictions. Similar prophecies in Mexico were not so clearly attributed to the stars (Garcilasso, *Commentarios reales*, tr. Markham, Hakluyt Society, v. 28, ix. 14; Humboldt, *Views of Nature*, London, 1856, p. 429; Prescott, *Conquest of Peru*, bk. ii. ch. 6).

4. Ritual.—The ceremonials of the various tribes also include astronomical features; in fact many of their elements seem to have originated in the wish to imitate on earth the aspects and movements of the celestial world. The imitations of animals in the dances of the primitive tribes arise among those more advanced to elaborate figures, dances, and processions reflecting the orderly movement of the sun and stars across the sky and the progress of time and of the seasons. The American Indians as a whole are a thoughtful and religious race, much given to ceremonials. Even their games and sports, even their ordinary details of domestic life, are made part of the religious ritual to be ceremonially performed, and from the grandest to the most insignificant details of their ritual much is based upon astronomical symbolism.

In the various ball games found from one end of the continent to the other, the movement of the ball originally represented that of the sun (Brinton,

Myths of the New World, New York, 1868, *American Hero Myths*, Philadelphia, 1882, p. 119). Among the Cherokees, prior to the contest, the opposing teams were carefully instructed in the use of magic formulæ, and the issue was supposed to depend upon the amount of magic power thereby developed (Mooney, in 7 *RBEW*, p. 301 ff.). In Yucatan and Central America the ball court itself represented the celestial field. The game was won by the player who drove the ball through a stone ring upon which two interlaced serpents, symbols of the eternal years, were sculptured. The *Popol Vuh* describes contests at this game, the result of which determined the control of *Xibalba*, or Shadow Land; and Mrs. Nuttall asserts that the ball courts were also used as astronomical observatories. The Araucanians saw the divine will in the result of the game, and used it to decide the fate of those accused of crime.

It is probable that the annual ceremonial hunts, once common in the South-western United States, formed a terrestrial imitation of the celestial Hunter, as in Peru, and foot-races also symbolized the solar journey. In the Mexican game of 'those who fly' the celestial revolution was symbolized by four men masked as eagles who circled about a pole at the end of four cords wound round it (Clavigero, *Historia*, ed. Mora, Mexico, 1844; Nuttall, *op. cit.* p. 24 f.). Dice games, common in North America, reflect the celestial imagery on both dice and board. The Mexican game of Patolli uses a cruciform board representing the four celestial regions, through the divisions of which a stone marker progresses like one of the celestial bodies (Sahagun, *op. cit.* vi. 8; Culin, 'American Indian Games' in 24 *RBEW*; Nuttall, *op. cit.* pp. 82, 87). A serpent-dance in which the dancers imitated the motion of the serpent existed until recently among the Micmacs and other Northern tribes, and in Peru. In the North the dance symbolized the movement of the Pleiades across the sky (Hagar, in *Congrès international des Américanistes*, New York, 1902, and *JAFL* xiii. 92 ff.). The famous serpent-dance of the Hopis, figured on Mexican and Central American monuments, was a rain-making ceremonial performed in August under the sign of the Tiger Sun (Leo). The well-known mural paintings in the Temple of the Tigers at Chichen Itza represent a similar ceremony also dedicated to the Tiger Sun. In the Mandan buffalo-dance, twelve dancers divided into groups of four represented the cardinal points, and doubtless also the twelve regions and the months. Two of the middle four were painted black and dotted white to represent the night sky and the stars. The other two, painted red, personated the day (Catlin, in *Smithsonian Report*, 1885, p. 359), and the movement represented alternating day and night. The Natchez ceremonially gathered to watch the rising and setting solstitial sun through the doorway of their temple. The sun-dances of various tribes dramatize the progress of time and the seasons. The nocturnal Iroquois feast of the dead seems to have celebrated the return of the spirits to earth over the Milky Way in spring and fall.

At the end of each fifty-two years' period the Mexicans expected that the midnight culmination of the Pleiades would mark the end of the cosmos, or its renewal for a like period. All fires were extinguished, and the advance of the Pleiades towards the critical point was observed from the summit of the mountain called 'Hill of the Star.' The stars having passed the meridian, a fire was kindled upon the summit, from which fires were re-lighted elsewhere, and the people gave themselves over to rejoicing (Sahagun, *op. cit.* tom. i. lib. 4, tom. ii. lib. 7; Torquemada, *Monarquia Indiana*, tom. ii. 292–295; Boturini, *Idea*, pp. 18–21; Clavigero, *Storia antica del Messico*, tom. ii. pp. 62, 84, 85; Mendieta, *HE*, p. 101; Acosta, *Hist. de las Yndias*, pp. 398–399). In Peru as in Mexico this date marked the entrance of the sun into the sign of the dead, symbolizing death, destruction, and renewal.

The rising of the morning star, the Pleiades, and Gemini was hailed with songs and dances by many tribes. In Mexico there was an annual sacrifice of a human being, who enacted the yearly course of the sun. He ceremonially ascended the steps of the *teocalli*, or god-house, to represent the sun climbing from the south to the northern solstice. At the moment when the sun reached the meridian he was slain, and his body was hurled down the steps to represent the declining course of the sun after the northern solstice (Hagar, *Peruvian Astronomy*). Similarly, among the Chibchas a human victim fastened on a pole was annually slain by the arrows discharged by a ceremonial procession of people masked and costumed to represent the various zodiacal asterisms (Duquesne, in Bollaert, *Antiquarian Researches*, p. 47).

About the time of the December solstice, though in recent times not every year, the Skidi Pawnees sacrificed a maiden to the morning star. There is no reason to doubt the indigenous origin of this very remarkable and suggestive ritual, which is described in art. PAWNEE, vol. ix. p. 699[a].

In similar obstacle legends among the more advanced tribal families of the American Indians there are indications that the astronomical symbolism was itself used to typify as the ultimate meaning the progress of the human soul (cf. Dorsey, in *Congrès international des Américanistes, XVe session*, Quebec, 1907, ii. 66–70, and Natalie Curtis, *The Indians' Book*, New York, 1907, pp. 102, 103; the deductions are the writer's, and will be found further developed in his *Peruvian Astronomy*).

A monthly ritual is known to have existed among the Pueblos, Mexicans, Mayas, Central American tribes, Peruvians, and probably the Chibchas. Among all of them the features of these festivals referred to some attribute of the zodiacal asterism through which the sun was supposed to be passing at the time.

The plan of the Peruvian temple of Cacha, or 'the messenger,' as well as the remarkable legend connected with it, points to a ceremonial procession enacting the yearly course of the sun within the building. The importance of the stellar cult in Peru is indicated by the fact that the Peruvians made images of all their constellations.

5. Mythology and star-lore.—The arch of the sky was generally regarded as a kind of transparent roof, over which the heavenly bodies walk. The Chinooks on the north-west coast and the Peruvians represented it by two oblique lines meeting in an acute angle. Possibly the 'Maya arch' possessed a similar symbolism.[1] On the Peruvian box the sky is seen as a woman's breast. It forms the clothing of the Huichol eagle-goddess and of the wife of the Pawnee Spirit of Life, and is symbolized by the concave interior curve of some Central American and Pueblo vases (Dorsey, *op. cit.* p. xviii; Stevenson, *op. cit.* p. 24). Above the sky dwells the Sun Father, with his wife the Moon Mother (who is sometimes also his sister), attended by the divine pair of the morning and evening stars, and surrounded by their stellar children.

The sun and moon were regarded as the progenitors of the stars and of mankind, but seldom or never as the supreme celestial powers. They

[1] Collection of A. F. Chamberlain; Hagar, *Peruvian Astronomy*, Salcamayhua Chart.

were the objects of a celestial cult existing practically everywhere in America, in which, at different times and places, sun, moon, and various constellations seem to have assumed predominance without occasioning more than a relative change of influence. Nor is there much evidence of conflict between the votaries of the various aspects of the astronomical cults. Sectarianism was almost unknown in the natural religions of America; such tortures and persecutions as existed in Mexico, for example, had little or no connexion with religious or theological differences. In Mexican tradition two men, one of them leprous, threw themselves into a fire and came out respectively the sun and the moon.

The gender of the sun and moon is sometimes reversed. A legend found in almost identical form among the Eskimos, the Cherokees, and the Amazon tribes personifies the moon as a man who secretly visited his sister at night. She, desiring to identify her unknown visitor, rubbed upon his face some black substance, which produced the lunar spots. A similar legend occurs among the Caddos (Dorsey, *Traditions of the Caddo*, Washington, 1905, pp. 11–12). The Iroquois saw in these spots an old woman who each month stirs a bowl of hominy with her cat (dog?) seated beside her. The Peruvians interpreted them as resulting from the embraces of a fox enamoured of her beauty; the Mexicans as a form of a rabbit, with which the gods struck the face of the moon, wishing to lessen its light, which formerly was as great as that of the sun. According to the Mexicans, the moon is always running after the sun, but never overtakes him. The divine being Quetzalcoatl made his son the sun, the god of water made his the moon (Phillips, *op. cit.*). The Onas of Patagonia make the sun pursue the moon (his wife) because she overheard some of the secrets of the male secret society. In terror she sprang off a cliff, the sun followed, and both jumped into the sky, where the pursuit continues (Barclay, in *Geographical Journal*, xxii. 62). In Corvichan tradition the sun, moon, and stars were shut up in three boxes, which were opened by the hero Yehl, whereupon they escaped to the sky (Deans, in *AAOJ* x. 111).

In higher Peruvian symbolism, the sun was tied by an invisible cord to the invisible pole of the sky, and was driven round it like a llama by the power of the Universal Spirit, although generally, after passing over the sky, he was thought to enter a cave in the west and to proceed by a subterranean passage to emerge next morning in the east. An equally interesting explanation of the origin of night and day is found in the Wichita legend (echoed by the Caddo) of the three deer, who are three stars, pursued by a fourth, which is a hunter who will overtake them at the end of the world. One deer is white, representing day, one black, representing night, one half black and half white, representing alternate day and night. The last was wounded, whence we have day and night (Dorsey, *Myth. of the Wichita*, Washington, 1904, pp. 21, 25–26, *Traditions of the Caddo*, pp. 13–14).

Among the Peruvian coast tribes, according to Garcilasso, the sun plunged into the western ocean and dried up the waters with his heat both where he entered and where he emerged—whence, apparently, the tides. In numerous North American legends he is visited by terrestrial travellers, whom he receives kindly, and to whom he sometimes imparts supernatural powers. The Mexicans described how he was once caught in a snare which a hero had contrived for him. This legend, which is also Polynesian, probably refers to the solstices, when the Indians generally thought of him as seated or resting, since they observed that for several days at these seasons he moved neither north nor south at his rising, but appeared at the same point on the horizon. The Mayas accordingly called these days 'the bed of the sun'; and at this time the Mexicans, Mayas, and Peruvians refrained from labour in imitation of the solar repose. The Mayas symbolized the June solstice by a tortoise, that of December by a snail, because of the slow motion of these animals (Forstemann, 'Commentary on Maya MSS' in *Peabody Museum Papers*, vol. iv. no. 1, p. 45, Cambridge, 1904; Schellhas, 'Representation of Deities of the Maya Manuscripts,' *ib.* no. 2, p. 115, Cambridge, 1906).

The Peruvians represented the sun as a bearded man in the prime of life, who impressed his footprint on a rock to mark the height of his power. This affords an explanation of a world-wide type of solar legends. Throughout America the solar rays were symbolized by hair. In Peruvian art the sun becomes the conventionalized face of a man upon which appear marks called tears by some, but perhaps having a pathological meaning. The Mexican hero Citli shoots three arrows at the sun and succeeds in wounding him. The enraged sun returns one arrow, which pierces Citli's forehead (Mendieta, *op. cit.* p. 77). The sun is the Spider Woman of some western tribes, the Ojibwa Wigwam of the Great Spirit, and the Zuñi shield of burning crystal which he carries, while the Kutenai Coyote manufactures the sun out of grease made into a ball (Chamberlain, in *AAOJ* xvii. 69). In Peru an oval plate, the symbol of the All-pervading Spirit, ultimately manifested in fire, earth, air, and water, was called the image of the true sun, of which the solar orb was only the reflexion. The sun, says the Quichua, Blas Valera, was the child of the Creator, and his light was that part of his divinity which the Creator had imparted to him. It was considered sacrilegious to look at his face; but early writers give several accounts of Inca rulers (particularly Huayna Ccapac) who did so, and who declared their scepticism of the supremacy of an object which never rested, but eternally moved upon its track like a driven animal, whose face the clouds obscured. From the nature of their light, gold was sacred to the sun and silver to the moon.

Eclipses were regarded as attacks made by some insect or animal upon the object enshadowed. In accordance with a world-wide custom, a terrific noise was made to frighten away the attacking monster, although the Tlascalans believed that the sun and moon were fighting. To induce them to cease, red-skinned people were sacrificed to the sun and albinos to the moon. The Peruvians thought the sun was angry when his face became obscured, while under like conditions the moon was believed to be ill. If her light disappeared altogether, she was dead and would fall from the sky upon earth, killing every one upon it. Dogs were beaten, as the moon was thought to be fond of them because they had rendered her a certain service, and it was hoped that their cries would induce her to uncover her face. A similar custom existed in Mexico (Ixtlilxochitl, *Hist. des Chichimèques*, Paris, 1840, cap. 6; Oviedo, *Hist. gen. y nat. de las Indias*, Madrid, 1851, xxix. 5; Piedrahita, *Hist. del Nuevo Reyno de Granada*, Antwerp, 1688, v. 1, vii. 6; Garcilasso, *op. cit.* xi. 1).

The altruistic spirit of the Pueblo community may be seen in the legend that the moon was once as bright as the sun, but gave up part of her light that people might sleep at night. According to the Sioux, the diminishing of the moon is caused by the nibbling of field mice, who thus prevent it from growing too large and injuring the earth (*Red Man*, xvi. no. 45). The profile face of the woman in the moon is figured on the Salcamayhua

chart. The Osages and the Mexicans seem also to have observed her. As the sun, being a male, watches over the fortunes of men, so the female moon is the guardian of women, to whom appeals for help were addressed in childbirth.

According to the Micmacs and Ojibwas, the stars are the lights of camp-fires before the wigwams of the dwellers in the land of the sky. Here and there we see them grouped in villages, and the brightest represent the largest fires before the dwellings of the chiefs. By other North American tribes they are described as birds that fly to the sky at night, by the Mexicans as eyes. Some Brazilian tribes regard them as rifts in the canopy of the eternally glowing sky-land (Seler, *Codex Vaticanus*, London, 1902, p. 44; Hagar, 'Micmac Star Lore,' MSS; Nery, *Land of the Amazons*, London and N.Y., 1901, p. 47). These simple and primitive notions existed coincidently with the division of the sky into constellations bearing the names of animals, plants, and frequently of inanimate objects.

Among the American tribes we find single stars named after individual objects, and groups forming true constellations; but probably nowhere in America is a constellation recognized which has become conventionalized like our own to such a degree that the derivation of the name is not really apparent from the alignment or other features. The morning and evening stars were naturally the most important of the stellar host. In the legends of the Cherokees, Peruvians, and others, the morning star appears before the first rising of the sun. It is the great star, the warrior, or messenger who goes in advance to announce the coming of his solar master. Its advent was hailed with incense and dances. It was widely symbolized by an equal-armed red cross. An Ojibwa legend makes it an older sister, who at her own desire was borne by the winds into the eastern sky, whilst her brother ran up a high mountain to hunt. So, according to Diodorus Siculus, the divine youth Hesperus went to the summit of a mountain at night to study the stars and a great wind carried him into the sky, where he became the evening star (Schoolcraft, *Hiawatha Legends*, Philadelphia and London, 1856, p. 90 ff.).

Among the Caddos the morning star was the errand man selected by the moon to be his assistant chief and to call the people together. He used to get up early during war expeditions, long before dawn, to go round the camps and wake the people so that the enemy would not find them. That is the reason why he gets up so early now. Morning Star has three brothers, Evening Star, North (Pole) Star, and South Star. Their father's name was Great Star, and he was the chief of the people (Dorsey, *Traditions of the Caddo*, pp. 7-8, 15).

In America the evening star was usually regarded as a woman, because it governed the time of family re-union at home, though among the Znñis it is the twin brother of the morning star. In Mexico it is the Lord who comes with his torch to light the dwellings on high, in Peru the female maize-grinder, the torch in the west, while among the Micmacs it is leader of the stellar tribe. Its symbol is frequently a white cross. It is the mother of all things to the Skidi Pawnee, who keeps a garden in the west in which the sun rests at night, where the corn is always ripening and much buffalo meat is stored (Schoolcraft, *op. cit.* p. 90 ff.; Cushing, *Zuñi Folk Tales*, New York, 1901, p. 378; Dorsey, *Traditions of the Skidi Pawnee*, pp. xv, 5; Hagar, *Peruvian Astron.*, ch. on 'Cult and Symbol,' pp. xv, 3). As the converse of the morning star, the Caddos believe that the evening star would go back a long distance upon the trail and warn his people if the enemy approached (Dorsey, *Traditions of the Caddo*, p. 15).

The identity of the planets, whether the morning or the evening star, was recognized in Peru Mexico, California, and parts of South America. The Peruvians made Mercury the ruler of merchants, travellers, and messengers. The Amazon tribes call it 'Deprived of Fish,' since it is believed to cause a scarcity of food fishes. Venus, in Peru, governed the daughters of the rulers, and women generally, dawn, rains, and flowers; Mars, war and soldiers; Jupiter, public matters and food supplies, and to him they offered firstfruits. The Peruvians placed Venus alone of all the stars in the dominion of the sun, evidently because it alone is sometimes visible in the full solar light. Because of its brilliant rays they called it Chasca, 'Curling Hair.' Because of its beauty they said that the sun never permitted it to wander far from his presence—a poetical interpretation of the fact that Venus never departs as far from the sun as the major planets. They also called this planet Chasqui, 'the Messenger,' because its swift passage from star to star suggested the swift running messenger upon the highways (Hagar, *Peruvian Astron.*, ch. on 'Cult and Symbol'). In the codices it is represented by numerous symbols, in the temple of Mexico by a high column, and in the myths it is identified with Quetzalcoatl. The Californian Indians say that the sun has two daughters, Mercury and Venus. Twenty men kill them, and after fifty days they return to life (Mendieta, *op. cit.* pp. 82, 83; Nuttall, *op. cit.* p. 53; Emerson, *Indian Myths, Legends, and Traditions*, Boston, 1885, p. 481; Nery, *op. cit.* p. 251; *Explication Codex Telleriano-Ramensis* in Kingsborough, *Mexican Antiquities*, 191).

The Milky Way in North America generally, and among the Guaranis of Paraguay, was the path of spirits, over which the souls of the dead pass between this world and the sky-land of the hereafter. Those of the good follow the broader and easier arm, those of the evil-doers the narrow and difficult arm. It is the Cherokee and Pueblo 'Way of Meal,' the Micmac 'Ancient Trail' and 'Way of Reeds,' the Californian 'Backbone of the Sky,' the Pawnee 'Dust raised by Buffalo Racing.' A Zuñi legend calls it the 'Great Snow Drift of the Skies' (Stevenson, *op. cit.* p. 25; Cushing, *op. cit.* p. 581; Dorsey, *Traditions of the Skidi Pawnee*, p. 57; Hagar, *Cherokee Star Lore* [in *Boas Anniversary Volume*, p. 354 ff.]). In Peru and at Znñi, as among the ancient Sumerians, it is associated with a gigantic celestial serpent. On the Osage star chart it is figured as a river, and it appears as a celestial stream in the mythology of the Peruvian and Amazon Indians. In Peru, as in the legends of the Ojibwas and Cherokees, and as in the Euphratean region, China, and Japan, this river is associated with the passage of souls. The Cherokees and the Kutenai also call the Galaxy 'the Way of the Dog,' the tribes of Guiana 'the Way of the Tapir' and the 'Path of the Bearers of Whitish Clay' (Brett, *Indian Tribes of British Guiana*, New York, 1852, p. 107; Chamberlain, in *AAOJ* xvi. 69).

In the sand paintings of the Mission Indians of California the outer circle is called 'Our Spirit,' a name of the Milky Way. The whole represents the world resting on the Milky Way. A gate or door to the north permits the escape of the soul at death.

The Cherokees recognize two dog stars, Sirius and Antares. In spite of the identical name of the former in our tradition, this is probably a native name, for it is explained by a Cherokee legend which bears no resemblance to its Oriental analogue. In it the two dogs act as guardians of

'the Way of Souls,' at the extremities of which they are stationed, and they must be propitiated with food before they will permit the souls to pass. The Winnebagoes, Ojibwas, and Huichols also recognize a dog star, and the Hindus and Zoroastrians likewise place two dogs upon the way of souls. The Caddos say that a dog gifted with prophetic powers talked with its master, the pair becoming two bright stars in the south (Dorsey, *Traditions of the Caddo*, p. 25).

The Pleiades are the most conspicuous constellation in the star-lore and ritual of the American Indians, though in North America they share the leadership with Ursa Major. Throughout America they are known as the stars of harvest and of the propitious rains. Their Peruvian name 'Granary' is echoed by the Eskimo 'Sharing-out of Food.' In allusion to their alignment they were generally known as a group of various objects: in Peru 'the Doves,' in Guatemala 'the 400 Young Men,' and in Mexico 'the 400 Rabbits,' patrons of feasting and of intoxication. They are also the Algonquian 'Sweating-Stones,' referring to the seven stones with which the sacred bath of the medicine-man was heated. Their Maya name and Micmac symbol, the rattle of the rattlesnake, suggest an association with the group of small mounds on 'the Way of the Dead' at Teotihuacan, for these mounds are traditionally dedicated to the stars, and from some of them have been exhumed large and erect rattle figures, which were evidently used as altars.

Another important aspect of the group is that of 'the Dancers,' suggested by the twinkling of the closely grouped stars. The whole stellar world follows the group, as they perform their cosmic dance across the sky; and so on earth their rising was hailed by Brazilians, Cherokees, Micmacs, and probably many other tribes, with an imitative song and dance referring more or less directly to the eternal procession of the heavens. The Iroquois, Housatunnuks, and Cherokees have, or had, an explanatory legend which describes how a group of boys, while dancing, ascended to the sky and became the Pleiades. Among the Caddos there are seven brothers who played all day long. Being scolded by their mother and refused food, they danced round the house, gradually rising from the ground until they reached the sky. As they disliked work, they disappeared in spring, when work time begins (Dorsey, *Traditions of the Caddo*, p. 64). The Blackfeet believe that they ascended because their fathers gave to their sisters, instead of to them, the yellow skins of the buffalo calves they had slain. In revenge they determined to go away each year when the buffalo calf skins became yellow. This occurs in May, when the Pleiades are hidden in the sunlight. The Kiowas call the Pleiades 'the Star Girls,' and they are probably represented by the dancing stellar maidens who descend to earth in the poetic legend of Algon. The seventh Pleiad appears in the Cherokee and Iroquois legends, in the former as a boy who is knocked down with a pole before reaching the sky, in the latter as a star whose light is dimmed because of his desire to return to earth (James Mooney, letter to author; R. W. Wilson, *AAOJ* xv. 149; Emerson, *op. cit.* p. 72; Sergeant, *Housatunnuk Indians*, Boston, 1753; Domenech, *Deserts of North America*, London, 1860; Schoolcraft, *Hiawatha Legends*, p. 116 ff.; Mrs. Erminie Smith, in *2 RBEW*, p. 80).

Almost invariably seven stars are attributed to the group, thus including one star which, though of the sixth magnitude while its companions are of the third and fourth, may be seen by one with strong sight or in a clear atmosphere. The Cherokees also relate that the seventh Pleiad fell to earth, leaving a fiery trail. He became a bearded man, who warned them of the coming flood. So in Peru the approach of the Pleiades to the meridian enabled the llamas of Ancasmarca to warn their shepherd of the coming of the annual deluge or rainy season in November. In Mexico the six *tzontemocque*, or stars which fall at the deluge, seem to have been Taurid meteors (Mooney, in *17 RBEW*, p. 621; *Explication Codex Telleriano-Ramensis*). 'If people will look at these stars (the Pleiades),' runs the Pawnee song, 'they will be guided aright.' Many tribes actually did use them as a guide by night (Morgan, *League of the Iroquois*, Rochester, N.Y., 1857, ii. 106). Everywhere the Pleiades are a peaceful, beneficent, and friendly constellation; and there are some indications in Peru and elsewhere that they were once regarded as being (or having special influence over) the home of souls.

The pole star of the Northern hemisphere seems to have been observed by all, or nearly all, the northern tribes. It is the Ojibwa 'Man who walks behind the Loon,' a disappointed lover, who, metamorphosed into a firefly, flew to the sky; in another version a hunter of bears. The Kutenai call it a female grizzly bear; but this apparently refers also to a constellation which includes Ursa Minor and Ursa Major. The Sioux declare that 'all stars walk around the pole star, which is the star that does not walk.' The Micmacs describe it as a bear hidden in a den, about which a group of hunters (Ursa Minor) eternally circle in a vain attempt to discover it. The Pawnees call it 'the star that does not move,' and regard it as the chief of the stars. In the Southern hemisphere the pole is indicated on the Salcamayhua chart as the apex of two slanting lines, which form the sky roof of the world. To it point three stars of the Southern Cross, called the male group, and having phallic attributes. The Maya name of Vega is 'Scrotum Star,' but this star ceased to mark the north pole several thousand years ago. The Peruvians used the Southern Cross to indicate the divisions of the night, the Mayas to indicate the seasons (Emerson, *op. cit.* p. 58; La Flèche in *AAOJ* vii. 106; Chamberlain, *ib.* 1770; Copway, *Traditional History of the Ojibway Nation*, London, 1850, p. 113 ff.; Dorsey, *Traditions of the Skidi Pawnee*, pp. 3-4).

The stars of Ursa Major seem to have been called 'the Bear' by the Indians of practically the whole of British America and the United States. An accompanying legend is found in almost identical form among the various Algonquian tribes, the Housatunnuks, Iroquois, and the Cherokees, but is given most fully by the Micmacs. The four stars of the body of Charles's Wain, or the Dipper, as Americans call it, form the body of the bear. The three following stars, ϵ, ζ, η, with four trailing behind them in the form of a bow (γ, ϵ, η Bootis, and Arcturus), are seven hunters, who are pursuing the animal. The little star, Alcor, close to the second hunter, is the pot in which they intend to cook her meat. Corona Borealis and μ, δ Bootis form the den from which she climbs down in the spring. In the summer she runs across the sky with the hunters in full pursuit; in the fall she is overtaken and shot, and begins to fall over on her back. The blood from her wound causes an eternal stain upon the breast of the foremost hunter, the robin, and, dripping upon the trees of earth, it gives to the foliage its blood-red autumn hues. But the bear eternally returns to life. Through the winter she lives in her den invisible (below the horizon), to issue forth again in spring, and thus eternally to renew the celestial drama. The seasonal features of the

legend correspond accurately with the actual positions of the stars in the early evening. There is good reason to believe that this is a native legend, or at least one of pre-Columbian origin, though the earliest reference to it seems to be by Le Clerq in 1691 (Hagar, in *JAFL* xiii. 92 ff.). In connexion with the hunting concept, it is noteworthy that the Wichitas regard the Great Bear as the patron of those about to engage in war expeditions (Dorsey, *Myth. of the Wichita*, p. 18).

The Blackfeet know the principal stars of Ursa Major as seven boys, all save the youngest of whom (Dubhæ) had been killed by their sister. The Sioux call the four body stars the coffin. It is borne by four men who are followed by mourners. Mizar and Alcor are called 'She who Comes with her Young One Weeping.' The Ojibwas also called these stars 'the Fisher,' and the Zuñis represented them by seven white pebbles in the rites of the 'Priesthood of the Bow.' The Pawnees described Corona Borealis as a circle of chiefs, in whose honour was founded the society of 'Chief Dancers.'

The Belt of Orion among the Point Barrow Eskimos becomes three men who were buried in the snow, the Micmac 'Three Fishermen,' the Zuñi 'Hanging Lines,' and the Patagonian 'Three Bolas,' or round stones with which animals are slain by hunters. The Peruvians, like the Basques and the people of Deccan, call it 'the Steps.' The whole constellation is the Zuñi 'Celestial Hunter' pertaining to the sun. In Peru it is symbolized by crossed arrows, and relates to hunters and hunting. A myth makes it the Promethean figure of a criminal raised aloft for punishment by two condors. It may be connected with the Mexican Citli, 'the Bowman.' The names of a few other constellations and single stars have reached us, but present no features of special interest.

In view of the similar and wide-spread symbolism associated with some constellations in America, a more or less uniform system of celestial symbolism may have existed through a large part of the continent, similar to the primitive symbolism of the eastern continent in some elements, yet unique in others.

Unquestionably many of the symbolical concepts have been transmitted from tribe to tribe for long distances. Many of them are of pre-European, or at least of pre-Columbian, origin, and the analogies which they present with Oriental symbolism must be explained either as like effects of like independent causes or by pre-Columbian intercommunication between the continents. The weakness of the former explanation lies in the complexity and conventionality of the concepts, and in the difficulty of tracing the symbolism to any natural basis. The American zodiacs, for example, reveal analogies with the ancient Oriental zodiacs in every sign, yet in few if any instances, either in the Orient or in the Occident, are we able to explain why these signs were so named or why their symbolical attributes are what they are. The zodiac is older than its seasonal associations; its origin remains unknown, yet we find it in similar form in America and in the Orient. The same argument applies, although perhaps less forcibly, to a large part of the astronomical symbolism of America.

LITERATURE.—The literature has been given throughout the article.

STANSBURY HAGAR.

SUN, MOON, AND STARS (Buddhist).—The astronomical ideas found in Buddhism do not form an independent system, but have developed in close relation with Hindu theories. The problem is rather to determine what stages of development are to be found in the canonical and later books. Thibaut[1] divides Indian astronomy into three periods: (1) that of the Vedas and *Brāhmaṇas*, (2) the middle period with a fully developed native Indian system, (3) the third period, showing Greek influence. The Buddhist scriptures cover a long time, some of the later containing references to the Greeks, but it is to the middle period, and rather to the early stages of this, that the astronomical notions of these works belong. They are in the main the same as those that we find in the *Purāṇas*. The Hindus had two important uses for astronomy: the sacrifices and astrology, neither of which was countenanced by the Buddhists. The latter had no special motive for paying close attention to astronomical theory beyond that required for determining the periods of the lunar month with its fast-days, the period of Retreat in the rainy season, and the divisions of the day. According to *Vinaya*, ii. 217, a monk who lives in the forest is to learn 'the positions of the lunar signs (*nakṣatras*), either the whole or one section, and is to know the cardinal points.'[2] At the end of the ordination service the process of 'measuring the shadow,' *i.e.* calculating the time of day, is performed in order to determine the seniority of the monk, and he is instructed in the length of the seasons and division of the day.[3]

1. **Position of sun and moon.**—The heavenly bodies that we see are the vehicles of gods, who have been thus reborn through their merit, and who are associated with the thirty-three gods, but below them in rank.[4] The moon, the sun, and the constellations come as gods in the retinue of Sakka to visit Buddha,[5] and in *Dharmasaṃgraha*, 10, the moon, sun, earth, and the *asura* Rāhu occur along with the guardians of the ten quarters as world-protectors. When sun and moon occur together, the moon is always mentioned first.

In the scriptures there is no systematic description of the heavenly bodies, but the account given in the *Sārasaṃgraha*[6] corresponds to scattered notices in earlier works and probably underlies them. The earth, a flat disk, is 1,203,450 leagues (*yojanas*) in diameter and 3,610,350 in circumference. In the centre is Mt. Meru, rising 84,000 leagues above the surface of the earth, and round it circle the sun, moon, and stars, shining in turn on the four continents round Mt. Meru.[7] Night is caused by the sun passing to the other side of Mt. Meru. The diameter of the moon is 49 leagues and the circumference 147; of the sun 50 and 150 respectively.[8] The sun as the vehicle (*vimāna*) of the god is one league higher in position than the moon. It is of crystal outside, gold within,[9] and hot within and without. The moon is of silver outside, of jewel within, and cool within and without. The sun has three paths—*ajavīthi*, *nāgavīthi*, and *govīthi*—according to its apparent course in the ecliptic during the seasons along the equator, and above or below.[10] This fact appears to be referred to in the *Sīlāni*,[11] where the sun and moon are spoken of as going along their paths or out of their paths. Whether there was any early theory

[1] *Astronomie, Astrologie, und Mathematik*, Strassburg, 1899, p. 4.
[2] *Vinaya Texts*, pt. iii. (*SBE* xx. [1885]) p. 294.
[3] *Upasampadā-kammavācā*, tr. J. F. Dickson, Venice, 1875, p. 13; I-tsing, *A Record of the Buddhist Religion*, tr. J. Takakusu, Oxford, 1896, p. 100.
[4] *Jātaka*, no. 450. [5] *Dīgha*, ii. 259.
[6] Cosmological passages are quoted in R. S. Hardy, *Legends and Theories of the Buddhists*, London, 1866, appendix.
[7] *Aṅguttara*, i. 227.
[8] The ratio of the diameter and circumference of a circle is thus 1 : 3, as in *Jātaka*, v. 271. This illustrates the rudimentary character of Buddhist astronomy.
[9] We should expect gold outside, but such is the text.
[10] So, but more elaborately, in the *Viṣṇu Purāṇa*, bk. ii. ch. 8.
[11] *Dīgha*, i. 10; cf. *Dialogues of the Buddha*, tr. T. W. Rhys Davids, London, 1899, i. 20.

of the cause of revolution, apart from the choice of the god of the luminary, is not clear. The Chinese sources of A. Rémusat state that five vortices of wind support and move the vehicle of the sun in the required directions, and five other vortices similarly move the moon.[1]

2. Eclipses.—Eclipses are due to the *asura* Rāhu, who is stationed at the moon's nodes, and periodically swallows the sun and the moon. The legend that Rāhu is the monster's head, severed when he was drinking the ambrosia produced at the churning of the ocean, appears not to be early Buddhist, nor even ancient Hindu. It is absent from the account of the churning in the *Viṣṇu Purāṇa*.[2] Buddhaghoṣa describes Rāhu not as a head, but as having a complete body, of which he gives the dimensions.[3] The Puranic notion of Ketu as the severed body of Rāhu at the descending node, although mentioned in *Mahāvyutpatti*, 164, and implied in *Abhidhānappadīpikā*,[4] 61, among the 'nine planets,' is a late borrowing from Hinduism. Two ancient *suttas* describe the moon and sun as being afflicted by Rāhu and appealing to Buddha, who commands Rāhu to let them go.[5]

3. Planets.—The stars also are said to move along and out of their paths.[6] The term here used for star is *nakkhatta* (Skr. *nakṣatra*), and probably refers to the planets, as Buddhaghoṣa understands it in this context.

The only planet distinctly mentioned in the *Suttas* is Osadhitārakā. That this is Venus may be inferred from its being described as the brightest of the luminaries next to the moon and as appearing in the morning.[7] The Sanskrit recension of the *Dīgha* passage in *Mahāvyutpatti*, 71, definitely identifies it with Venus by substituting Uśanas, one of the Sanskrit names of this planet, for Osadhi. The name Osadhitārakā is unexplained. The phrase *Osadhī viya tārakā*, 'like the star Osadhi,'[8] shows that it does not mean 'star of plants' (as in *oṣadhīpati*, 'lord of plants [or of the *soma*-plant],' a title of the moon). The possibility that *osadhī* is a corruption of *auṣasī*, 'star of dawn,' is attractive, but there is nothing in texts or commentaries to support it. The same is the case with the view of Kern that it is a corruption of *osanī*=Skr. *auśanī*, a derivative of *uśanas*.[9]

4. The lunar zodiac.—The term *nakṣatra* has been from late Vedic times applied especially to 27 or 28 constellations lying roughly along the ecliptic and forming a lunar zodiac; and from the Buddhistic use of many of them as proper names it may be inferred that they were known to the earliest Buddhists. They are as follows:

(1) Assayuja (β, γ Arietis), (2) Bharaṇī (35, 39, 41 Arietis), (3) Kattikā (Pleiades), (4) Rohiṇī (Hyades), (5) Magasira (λ, ϕ Orionis), (6) Addā (α Orionis), (7) Punabbasu (Gemini), (8) Phussa or Tissa (θ, δ, γ Cancri), (9) Asilesā (ϵ, δ, σ, η, ρ Hydræ), (10) Maghā (Regulus), (11) and (12) Pubba- and Uttara-phagguni (δ, θ, β, 93 Leonis), (13) Hattha (δ, γ, ϵ, α, β Corvi), (14) Chittā (Spica), (15) Sāti (Arcturus), (16) Visākhā (Libra), (17) Anurādhā (δ, β, π Scorpionis), (18) Jeṭṭhā (Antares), (19) Mūlā (λ Scorpionis, etc.), (20) and (21) Pubba- and Uttara-asālha (δ, ϵ, σ, ζ Sagittarii), [(22) Abhiji (Vega)], (23) Savaṇa (Aquila), (24) Dhaniṭṭhā or Saviṭṭhā (Delphin), (25) Satabhisaja (λ Aquarii, etc.), (26) and (27) Pubha- and Uttara-bhaddapadā or -poṭṭhapadā (the square of Pegasus), (28) Revati (ζ Piscium, etc.).[10]

No. 22 in this list is not in the *Abhidhānappadīpikā*. It was early omitted in Hindu astronomy, but the existence of Abhiji (Skr. Abhijit) in the Buddhist system may be inferred from the statement that the number of *nakṣatras* is 28[11] and from the existence of Abhijika as a proper name.[1] It also occurs in *Mahāvyutpatti*, 165, and in the list of Rémusat.[2]

References to other fixed stars than *nakṣatras* are rare in all Indian literature. The descent of the Heavenly Ganges, a myth relating to the Milky Way, is referred to in the canon, but never in any astronomical connexion. In *Jātaka*, vi. 97, seven sages are mentioned, but their names are not those which Hindu mythology gives to the seven *ṛṣis*, after whom the seven stars of Ursa Major are named. The name Sakaṭa, 'the cart,' in *Dīgha*, ii. 234, is probably a name of Rohiṇī, as suggested by S. Konow.[3] It is so named by several Hindu astronomers.[4]

5. Months.—The moon in the course of a year may be full in any of the *nakṣatras*, and we find such expressions as *Visākhapuṇṇamā*, 'full-moon when the moon is in Visākhā'; but there had been established earlier than Buddhism a system of twelve lunar months, with names derived from certain of the *nakṣatras*. These are:

(1) Chitta (Mar.–Ap.), (2) Visākhā (Ap.–May), (3) Jeṭṭha (May–June), (4) Āsālha (June–July), (5) Sāvaṇa (July–Aug.), (6) Poṭṭhapāda (Aug.–Sept.), (7) Assayuja (Sept.–Oct.), (8) Kattika (Oct.–Nov.), (9) Māgasira (Nov.–Dec.), (10) Phussa (Dec.–Jan.), (11) Māgha (Jan.–Feb.), (12) Phagguna (Feb.–Mar.).

These names were later applied in Hindu systems also to the twelve solar months, but in the canon the reckoning appears to be always lunar, as well as in the Ceylon chronicles.

The month is divided into two parts (*pakkha*), the dark (*kāḷa*) from full to new moon, and the light (*sukka, juṇha*) from new moon to full. Whether the month ended with full or new moon is not clear, but the fact that the dark half is mentioned first and that the months of Retreat began the day after a full-moon day and ended on a full-moon day, suggests that the full-moon day was the end. Both methods were in use by the Hindus in Vedic times, as they are at the present day.[5]

6. The week.—The division of the half month at the eighth and fourteenth or fifteenth day easily led to the reckoning of seven days as a usual period (*sattāha*), but there is no trace in the Pāli writings of the system (no doubt non-Indian in origin) of naming the week-days from the names of the sun, moon, and planets. These names occur in the order of the days of the week as the first seven of the nine planets in *Mahāvyutpatti*, 164.

7. The year.—In *Aṅguttara*, i. 213, where the length of a year of the gods is given, it is said to be a year of twelve months, the month being made up of 30 nights (and days). This gives a year of 360 days, and is the exact number in use in the Vedic period.[6] The number 30 is probably obtained by adding together the 15 days of each half of the lunar month. In practice the number would be sometimes 29 and sometimes 30, as the synodic lunar month is rather over 29½ days. There must have been a mode of intercalating months to bring the lunar months and solar year into harmony from time to time, as in the case of the Hindu systems, but the process is unknown. The modern Siamese have a year of 354 days, the months being alternately of 29 and 30 days. In every third or second year (seven times in 19 years) the eighth month is reckoned twice, and in every fifth or sixth year one day is added to the seventh month, bringing the lunar year into harmony with the solar year.[7]

The Hindu systems have two modes of beginning

[1] *Mélanges posthumes d'hist. et de litt. orientales*, Paris, 1843, p. 83.
[2] Bk. i. ch. 9.
[3] Comm. on *Dīgha*, no. iv. § 6.
[4] This work (of the 12th cent.) was the chief source of the astronomical items in R. C. Childers, *Dictionary of the Pali Language*, London, 1875, but it is based largely on Hindu sources, and forms no independent evidence for Buddhist astronomy. The nine planets are the moon, sun, five greater planets, Rāhu, and Ketu (*Mahāvyutpatti*, 164).
[5] *Saṃyutta*, i. 50 f., tr. C. A. F. Rhys Davids, in *Kindred Sayings*, London, 1918, i. 71.
[6] *Dīgha*, i. 10.
[7] *Majjhima*, ii. 34.
[8] *Vimānavatthu*, i. ix. 1.
[9] *Verspreide Geschriften*, The Hague, 1913, ii. 250.
[10] From *Abhidhānappadīpikā*, 58–60. Exact identifications of them are given by W. D. Whitney in *Sūryasiddhānta*, tr. E. Burgess, New Haven, 1860, p. 324; cf. *Nakṣatra* in A. A. Macdonell and A. B. Keith, *Vedic Index of Names and Subjects*, London, 1912.
[11] *Mahāniddesa*, 382; *Jātaka*, Com. vi. 476.

[1] *Saṃyutta*, ii. 204.
[2] P. 85.
[3] *JPTS*, 1909, p. 13.
[4] H. Kern, note on Varāhamihira's *Bṛhatsaṃhitā*, ix. 25, tr. in *Verspreide Geschriften*, i. 217.
[5] Thibaut, p. 12; R. Sewell and S. B. Dikshit, *The Indian Calendar*, London, 1896, § 13; see art. FESTIVALS AND FASTS (Buddhist).
[6] Thibaut, p. 7.
[7] F. J. Wershoven, *Lehr- und Lesebuch der siames. Sprache und deutsch-siames. Wörterbuch*, Vienna, 1892.

the year: (1) with the full moon of Kattika, (2) with the month Chitta.[1] The former is implied in the usual Buddhist reckoning of the three seasons, in which the cold season is always mentioned first.[2] This period was also the end of the Retreat, in which the annual redistribution of robes took place. The second mode of beginning the year is implied in the *Dīpavaṃsa* and in the list of lunar months in the *Abhidhānappadīpikā*, which begins with Chitta.[3]

8. Seasons.—The ancient Hindu seasons are three: *hemanta*, the cold season from Māgasira to Phagguna; *gimha*, the hot season from Chitta to Asalha; and *vassa*, the rainy season from Sāvaṇa to Kattika. These dates, however, would vary from year to year through the irregularity caused by the lunar months and occasional intercalation.[4]

Dīpavaṃsa, xii. 44, calls Jeṭṭha the last of the hot months. *Vassa* in the sense of Retreat does not correspond with the rainy season, but extends over three months of that period. The Hindu subdivisions of the three seasons into five or six[5] are not found in Pāli works, but there are occasional references to autumn (*sarada*) as the early part of *hemanta* and to spring (*vasanta*) as the early part of the hot season.[6] *Mahāvyutpatti*, 253, gives the list of six, and I-tsing[7] also describes other systems of division used in various localities.[8]

9. Astrology.—Indian astrology, as the science of omens drawn from celestial phenomena, is a branch of divination. It is stigmatized in *Dīgha*, i. 10, as a base science and false means of livelihood. In the *Sutta Nipāta*, 927, the monk is forbidden to devote himself to magic (*āthabbana*), to (the interpretation of) the dream, the sign, and the *nakṣatra*. That such a science is possible is generally taken for granted, but in the *Jātaka* there is a tendency to ridicule the belief in lucky *nakṣatras*,[9] omens,[10] names,[11] and sneezing. There is no reason to think that this sceptical attitude is primitive; it is rather the rationalizing of a single individual or of a school. The survival of the belief within orthodox Buddhism is shown in the collection of *suttas* drawn from the canonical books called the *Paritta*, which, among other formulas intended to ward off hostile powers or to win their favour, contains the two *suttas* on the eclipse of the moon and of the sun.[12]

A fragment of a MS of an astrological work in corrupt Sanskrit has recently been discovered in East Turkestan at Khotan.[13] It is shown to be Buddhist by the phraseology, as well as by the reference to the *ṛṣi* Kharuṣṭa, who makes known to the congregation the knowledge of 'nights, days, moments, planets, half-months and months.'[14] The matter is similar to that in Hindu astrological works, such as: what *nakṣatras* are effective for conception, which are causers of misfortune or success in certain undertakings. There can be little doubt that it is borrowed from some Hindu work, and, like later works of this kind, it shows the influence of Greek astronomy in the use of such terms as *hora*, and the names of the 12 signs of the zodiac (Pisces, Scorpio, etc.) along with those of the *nakṣatras*.

LITERATURE.—The sources and authorities are given throughout the article. EDWARD J. THOMAS.

SUN, MOON, AND STARS (Celtic).—**1.** Very little is known about the astrology and astronomy of the Celts. The Druids, as we learn from Cæsar (*de Bell. Gall.* vi. 14), discussed and transmitted to their disciples many questions regarding the stars and their motion. They had observed the course of the moon, and by it they regulated their calendar. Their months and years began with the sixth day of the moon (Pliny, xvi. 95, 250); they counted by nights (Cæsar, vi. 18. 2); and their cycle was one of thirty years (Pliny, xvi. 95, 250).

The discovery of the calendar of Coligny has made it possible to determine these general ideas for the Gallo-Roman period. This calendar gives a year of 354 days, divided into twelve months of twenty-nine and thirty days alternately. To establish agreement between the lunar and the solar year a month of thirty days was intercalated every two and a half years. At the beginning of every fifth year there was complete agreement between the two methods of calculation; and probably this was the occasion, as Jullian remarks, on which were offered the quinquennial sacrifices of which Diodorus speaks (v. 32. 6).

Astrology, properly so called, does not seem to have been practised by the pagan Irish. But in the 'Lives of Saints' there are to be found some superstitious practices derived from the observation of the stars. The foster-father of Columcille goes to ask a prophet when he should begin to teach the child to read. The prophet after having examined the heavens replies that he must begin immediately (*Lives of Saints from the Book of Lismore*, l. 812). Manannan mac Lir used to know by studying the sky when there would be fine weather and when bad (*Cormac's Glossary*, p. 114).

The scientific observation of stars was also in use among the ancient Irish. Loeg observes the stars to ascertain when midnight comes (*Mesca Ulad*, 13). Some treatises on Irish astronomy dating from the early Middle Ages have been preserved. They are founded on the system of Ptolemy, and seem to be translations of foreign works. The words used to denote the sun-dial are borrowed from the Latin. Yet the Irish were particularly clever at calculating dates, and in the *Saltair na Rann* it is told that every intelligent person should know the day of the solar month, the age of the moon, the flow of the tide, the day of the week, and the chief saints' festival days. Perhaps in the ancient Irish and Welsh texts there are traces to be found of the primitive Celtic calendar. The year was divided into two halves or into four periods of three months, the month being divided into two parts. The periods of time most in use were those of three nights and three days, or nine nights and nine days, while the most common cycles were those of three years and of seven years. In Armorican Brittany and in Wales the names of the complementary days which served to convert the lunar year into a solar year (Brit. *gourdeziou*, Welsh *dyddiau dyddon*) have been preserved. Several popular superstitions are attached to them. Thus a medical manuscript mentioned by O'Curry contains a list of unlucky days, and in Irish literature there are numerous examples of births delayed in order that they may take place on a lucky day, and of disasters which might have been prevented if an undertaking had not been engaged in on an unlucky day.

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[1] Whitney, p. 270. [2] *Vinaya*, i. 137.

[3] There is no reason for thinking that the year ever began with Sāvaṇa. The recurring phrase *Komudī chātumāsinī* does not mean the full moon of Kattika 'in the fourth month,' but 'at the Chāturmāsya festival.' See T. W. Rhys Davids and H. Oldenberg, in *Vinaya Texts*, pt. i. (*SBE* xiii. [1881]) p. 324, n. 2; *Jātaka*, vi. 221; *Dīpavaṃsa*, xv. 1. On the Chāturmāsya, or 'Four month' celebration, see art. FESTIVALS AND FASTS (Hindu).

[4] See the Commentaries on *Sutta Nipāta*, 233, p. 192, and *Vimāna Vatthu*, vii. 5, 6.

[5] Thibaut, p. 11.

[6] *Majjhima*, i. 115; *Jātaka*, i. 86; Com. on *Sutta Nipāta*, 233.

[7] Pp. 101, 219.

[8] See also art. CALENDAR (Buddhist).

[9] 49. [10] 126, 155. [11] 97.

[12] See artt. MAGIC (Buddhist) and DIVINATION (Buddhist), where the later developments of Buddhist astrology are given. See also, for modern Sinhalese Buddhism, E. Upham, *The History and Doctrine of Budhism popularly illustrated; with Notices of the Kappooism, or Demon Worship, and of the Bali, or Planetary Incantations of Ceylon*, London, 1829; for Tibetan, E. Schlagintweit, *Buddhism in Tibet*, Leipzig and London, 1863; for Chinese, Rémusat, *Mélanges posthumes*, p. 84 ff.

[13] *Manuscript Remains of Buddhist Literature found in Eastern Turkestan*, ed. A. F. Rudolf Hoernle and others, Oxford, 1916, i. 121.

[14] Cf. *Dīgha*, iii. 85.

2. The Gallic god Belenos had been assimilated to Apollo as a healer rather than as a sun-god. We have no evidence of worship of the stars among the Gauls except a few dedications to the sun and the moon in Gallo-Roman inscriptions (A. Holder, *Altceltischer Sprachschatz*, 3 vols., Leipzig, 1896–1913), and the mention of the worship of an image of the sun (*AS*, 4 Sept. ii. 197 C). No conclusion can be drawn from the representation of stars on the shields of the Orange-arch, from the *rouelles* dug out in so great a number, or from the wheel that is an attribute of a Gallo-Roman god assimilated to Jupiter; for the stars may be ornaments or armorial bearings, and the wheel may be a divination-wheel or a symbol of the thunder as well as a symbol of the sun. Some customs of the ancients may be connected with the beliefs relating to the stars—*e.g.* the gathering of the mistletoe and the beginning of the years and months on the sixth day of the moon (Pliny, xvi. 250), the dread of the Asiatic Galatians during an eclipse of the moon (Polyb. v. 78).

The evidences of the worship of the sun and the moon in ancient Ireland are not numerous. The most explicit text is in the *Confessio* (§ 60) of St. Patrick, in which he alludes to worshippers of the sun. G. Keating (*History of Ireland*, ed. D. Comyn and P. Dinneen, 1902–1908, bk. i. § 12) says that one of the Dê Danann was named Mac Gréine, 'Son of the Sun,' because his god was the sun. A passage of *Cormac's Glossary* (p. 54) tells us that Irish pagans used to carve some pictures—*e.g.* that of the sun—on the altars of their idols, and Keating (ii. 11) relates that in Columcille's time a priest of Tirconnel who had set up images of the sun and the moon in the church was carried off by a devil. The king of Ulster, Loegaire, swore by the name of the elements—the earth, the sun, and the wind (W. St. Boroma, *RCel* xiii. [1892] 52 f.).

LITERATURE.—J. Loth, 'L'Année Celtique' in *Revue Celtique*, xxv. (1904) 113–142; P. W. Joyce, *A Social History of Ancient Ireland*, London, 1903, i. 464–471; C. Jullian, *Histoire de la Gaule*, Paris, 1907, i. 393, ii. 124, 141. G. DOTTIN.

SUN, MOON, AND STARS (Chinese).—I. *INTRODUCTION.*—The Chinese view of the sun, moon, and stars taken as a whole may be likened to a web woven of three different threads: the thread of astronomy, the thread of religion, and the thread of astrology. Astronomy means here the observation of the heavenly bodies and the truths deduced therefrom, chiefly for practical purposes. It may therefore be called 'observational' astronomy, as distinguished from what is called 'physical' or 'descriptive' astronomy, founded by Galileo after his invention of the telescope, and it may also be called 'practical' astronomy, as distinguished from what is called 'theoretical' astronomy, founded by Newton on the hypothesis of the law of gravitation. The religious view of the Chinese concerning the heavenly bodies may be called astrological, and their astrological view may be called religious in the comprehensive sense of the term. But a clear line of distinction can be drawn between them. The idea of deity or God is always present and predominant in the religious view, whereas it may be vague and even absent in the astrological view. The latter is concerned chiefly with the influences of the heavenly bodies upon men, while the former is concerned chiefly with the relation of God to men as revealed in the heavenly bodies—*i.e.* God's messages and warnings derived by means of the observation of the heavenly bodies.

The Chinese term for the study of the heavens is *tien wen*, literally 'the system (or order) of heaven.' The term is not limited to purely astronomical knowledge, but has been applied equally to astrological and religious beliefs or views concerning the heavens.

Chinese astronomy has been of much interest to many European scholars, its great antiquity being widely admitted.

'The progress of Astronomy among the Chinese,' says John Williams, 'is a subject of highest interest whether it be considered as recording observations of the heavenly bodies made by one of the most ancient and primitive races of mankind, which appears in extremely remote time to have advanced to a high degree of civilisation; peculiar, however, to itself; and which has preserved the manners and customs established by its early rulers more than two thousand years before the Christian era, in a great measure unaltered to the present day. Or whether the fact that at a period long anterior to the commencement of civilisation among the Western nations, and when almost universal barbarism prevailed among them, astronomy had been carried to a great degree of perfection by the Chinese, as manifested by their still existing records, whose authenticity is not only strongly asserted by that people, but is acknowledged by some of the most eminent European scholars of the present day.'[1]

It has been said by some of the authorities of our own century that the antiquity of Chinese astronomy is 'greater even than that of almost any other nation.'[2] But the study of the heavens in China is not pursuit of knowledge, or astronomical knowledge, for its own sake. Being a highly practical nation, the Chinese, when they seek to know anything, generally have some end or ideal in view to the attainment of which knowledge is merely a means. The present case is not an exception. Having to arrange all their religions ceremonies, social and governmental affairs, and, most important of all, their agricultural work according to the seasons, the Chinese, even at the earliest period of their history, felt the great need of a proper calendar, the formation of which required astronomical knowledge. Apart from this, there were other motives—the religious and the astrological. The latter explains itself, and the former has a double purpose. On the one hand, the Chinese sought to know the laws of the heavens, which were for them, in some sense, divine, in order to apply them to their own conduct, social as well as individual. The doctrine of the imitation of, or the conformation of men's conduct with, the laws of the heavens has been much held by Confucianists, and especially by Taoists, and can be found in most of the Chinese classics. On the other hand, as they believed the celestial phenomena to be God's revelations or warnings to men, they wanted to know them in order to re-adjust their conduct.

Both the astronomical and the religious views of the Chinese concerning the heavens are as old as their history, and it is difficult to tell which is earlier; their astrology is a later development. The Chinese term for 'astrologer' is *êrh tse* or *sing tse*, which may be translated 'the man of sun' or 'the man of stars.' According to the Chinese records, the former term did not occur until the 5th cent. B.C., and the latter is of still later date. Kepler says that astronomy is the wise mother and astrology the foolish daughter. If we may adopt this saying with a little modification, we can regard the astrology of the Chinese as the daughter of their astronomy and religion. These three different views have for thousands of years influenced the Chinese mind, and the astrological view, though the latest, has almost since its birth been the most powerful. Even at the present day among many of the Chinese astronomy has not divorced itself from religion, nor has it disowned or rid itself of astrology, as Western astronomy has since the 16th century.

II. *THE ASTRONOMICAL ASPECTS.* — The

[1] *Observations of Comets*, London, 1871, p. vii.

[2] E. B. Knobel, 'Abstract of a Lecture on Chinese Astronomy' in *Journal of the British Astronomical Association*, xix. [1908-09] 338.

Chinese are great believers in their ancient classics, so that to deal with their ancient views and beliefs is to a great extent to deal with their modern ones as well. The great antiquity of Chinese astronomy has been admitted by many of the best European scholars of both the last and the present century. According to tradition, a sort of calendar was invented by Fu Hsi (3328 B.C.) as a result of observations of the phenomena of the heavens. The reformation of the calendar and the rectification of intercalation are attributed to Hwang Ti, or the Yellow Emperor (2698 B.C.). In the record called *Ssŭ Ki* of Ssŭ Ma Chien, China's most famous historian (2nd and 1st centuries B.C.), it is recorded:

'Hwang Ti commanded Hi Ho to take charge of the observation of the sun, Yih Chang the observation of the moon, and Yu Chu the observation of the stars.'

He is also said to have brought into use the lunar cycle of nineteen years, by which the conjunctions and oppositions of the sun and moon can be calculated, and the intercalary months regulated. This was more than 2000 years before the introduction of the same system among the Greeks by the astronomer Meton.[1] *The Annals of the Bamboo Books*[2] record that at the time of the reign of Tsuan Hsu (beginning 2513 B.C.) a conjunction of the five planets was observed by the Chinese in the constellation called Yin Shih or Shih.[3] It has been carefully calculated and asserted by the French astronomer, Jean S. Bailly, that such a conjunction did take place on 29th Feb. 2449 B.C., which would be the 65th year of Tsuan Hsu's reign. In the time of the emperor Yaou (2356 B.C.) the Chinese already knew the exact, or almost exact, number of days in a year, had a way of determining solstices and equinoxes, and had in use an intercalary system and some instruments for the survey of the heavens, and the knowledge of the five planets and of the twelve zodiacal signs, and most probably of the 28 stellar divisions.

In the 'Canon of Yaou,'[4] the first book of the *Shu King* ('The Canon of History'), we read:

'Thereupon Yaou commanded He and Ho[5] to have reverence to the great heavens, and to calculate and delineate the movements and appearances of the sun, the moon, the stars, and the zodiacal spaces; and so to deliver respectfully the seasons to the people.

He separately commanded the second brother He to reside at Ye-e, in what was called the Bright Valley, and there respectfully to receive as a guest the Rising Sun, and to adjust and arrange the labours of the Spring. "The day," he said, "is of the medium length, and the star is in Neaou;[6] you may thus exactly determine mid-spring. The people begin to disperse; and the birds and beasts breed and copulate."

He further commanded the third brother He to reside at Nankeaou, and arrange the transformations of the summer, and respectfully to observe the extreme limit of the shadow. "The day," said he, "is at its longest, and the star is Ho;[7] you may thus exactly determine mid-summer. The people are more dispersed; and the birds and beasts have their feathers and hair thin, and change their coats."

He separately commanded the second brother Ho to reside in the west, in what was called the Dark Valley, and there respectfully to convoy the setting sun, and to adjust and arrange the completing labours of the autumn. "The night," he said, "is of the medium length, and the star is Hiü;[1] you may thus exactly determine mid-autumn. The people begin to feel at ease; and birds and beasts have their coats in good condition."

He further commanded the third brother Ho to reside in the northern region, in what was called the Sombre Capital, and there to adjust and examine the changes of the winter. "The day," said he, "is at its shortest, and the star is Maou;[2] thus you may exactly determine mid-winter. The people keep their cosy corners; and the coats of birds and beasts are downy and thick."

The emperor said, "Ah! you, He and Ho, a round year consists of three hundred, sixty, and six days.[3] By means of an intercalary month do you fix the four seasons, and complete the determination of the year. Thereafter, in exact accordance with this, regulating the various officers, all the works of the year will be fully performed."'

In the 'Canon of Hsun,' the second book of the *Shu King*, it is recorded that, having accepted the throne which had been often offered to him by the emperor Yaou, the emperor Hsun examined the gem-adorned sphere and the gem transverse tube in order to regulate the seven directors or planets.

Both the commandment of Yaou and the examination of Hsun are supposed to have taken place at the beginning of their reigns. The observation of the heavens then must have been of great importance. According to another book of the *Shu King*, called 'The Punitive Expedition of the Prince Yin,' in the reign of King Tsung Kang (2159–2146 B.C.) there were astronomers who failed to foretell an eclipse of the year 2158 B.C. (?), and it was considered such a great crime that the prince of Tin, who was then commander-in-chief of the imperial armies, received orders from the king to punish them with the imperial forces.

The Chinese then commenced their observation of eclipses from a time not later than the 22nd cent. B.C., though some European scholars regard the eclipse of the sun on 29th Aug. 775 B.C., recorded in the *Shi King* ('Book of Odes'),[4] as the earliest recorded eclipse in all history. In Ma Twan Lin's *Encyclopædia* more than 600 eclipses of the sun are recorded from 2168 B.C. to A.D. 1223. There are many other kinds of heavenly phenomena which have been keenly observed by the Chinese from a very early period as well. From 611 B.C. to A.D. 21 alone comets are recorded 372 times, as shown in Williams' *Observations of Comets*. The spots of the sun were observed and recorded by the Chinese not later than A.D. 301, *i.e.* 1308 years before the assumed first discovery of solar spots by Galileo in A.D. 1610 and 1300 years before the invention of the telescope. 48 observations of solar spots, from A.D. 301 to 1205, are recorded in Ma Twan Lin's *Encyclopædia*, which was published in A.D. 1323, *i.e.* 288 years before Galileo's observation. In the same *Encyclopædia* a great number of instances of the observation of moving or shooting stars are recorded from 1122 B.C. to A.D. 1230. Meteors have been observed, and recorded by the Chinese since, as early as 1578 B.C. The *Bamboo Books* record: 'In the tenth year [of the emperor Kwei of the Hia dynasty, *i.e.* 1579 B.C.] the five planets went out of their courses. In the night stars fell like rain.' Comparing it with the year A.D. 1866, remarks E. B. Knobel, when they had the great display of meteors, the interval gave 104 periods of 33·11 years. Now Leverrier's period for the November meteor is 33·25. Thus it is hardly possible to doubt that

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[1] See Williams, *Observations of Comets*, Introduction.

[2] A large collection of ancient documents, discovered A.D. 279; see James Legge's tr. in *Chinese Classics*, Hongkong, 1861–72, vol. iii. pt. i.

[3] One of the 28 stellar divisions determined by α, β, and other stars in Pegasus, extending north and south from Cygnus and Piscis Australis and east and west 17° and comprising part of Capricornus and Aquarius.

[4] Legge, *Chinese Classics*, vol. iii. pt. i. [1865] pp. 15–27.

[5] Names of two families which had been hereditary officers of the Board of Astronomy since the time of Hwang Ti.

[6] Neaou is a space of heavens extending over 112° and embracing the seven constellations of the southern quarter. The star in Neaou is, according to the view held by Chinese scholars and adopted by many Western scholars, such as James Legge, John Williams, etc., the star Tsun Hwuo, corresponding to Cor Hydra. After an elaborate calculation Williams says (p. xi) that that star should culminate at sunset on the day mentioned in the *Shu King*. He then says: 'Thus a strong presumptive proof is again afforded of the veracity of the Chinese history as recorded in the *Shu King*.'

[7] The central star of the seven constellations of the eastern quarter, corresponding to the heart of Scorpio.

[1] The central star of the seven constellations of the northern quarter, corresponding to β Aquarii.

[2] The culminating star of the seven constellations of the western quarter, corresponding to the Pleiades.

[3] 'When it it said,' says the editor of Yung Ching's *Shu King* (James Legge's tr.), 'that the year consists of 366 days, we are to understand that Yaou was speaking in round numbers. The period in question is now called the value of the years. It has been differently estimated by the astronomers of successive dynasties.'

[4] II. iv. 9; Legge's tr., London, 1876, p. 229 f.

we have here the earliest record of a shower of those meteors.[1]

III. *DIVISION OF THE STARS.*—1. The 28 siüs or shĕs.—In common with the Hindus, Arabs, Babylonians, Persians, and Copts, the Chinese have the division of the ecliptic into 28 mansions, which are called *siüs* or *shĕs*. According to the interpretation of Ssu Ma Kuang, a great scholar of the Sung dynasty (A.D. 960–1279), *shĕ* has the meaning 'to reside (or to stop) somewhere' and *siü* means 'an abode,' and both words express the idea of the sun, the moon, and the five planets in their revolution residing in turn in the divisions of the sphere indicated as the 28 abodes. This meaning is very similar to that of the Hindu *nakṣatras* ('stars' or 'asterisms') and the Arabian *manāzil al-kamar* ('lunar mansions'). There is, according to Knobel's calculation, a concordance of the determinants of the *siüs*, the *nakṣatras*, and the *manāzils* in fifteen divisions, of the *siüs* and the *nakṣatras* in four divisions, of the *siüs* and the *manāzils* in five divisions, and of the *nakṣatras* and the *manāzils* in four divisions. This remarkable resemblance attracted the attention of many Western scholars and seemed to them a sufficient reason for presuming that all three systems sprang from a single source. The conclusions arrived at are different. Some hold that the system originated in India and the Chinese borrowed it from there; others are of opinion that the Chinese borrowed from the Arabs; another opinion is that the Babylonians were the originators; while still others say that the origin is to be found in Central Asia or some part of Persia. Unfortunately none of these conclusions is supported by satisfactory evidence.

But there are differences as well as resemblances between these three systems, and the Chinese division has its own peculiarity. The Chinese divisions are very unequal in the angular intervals and therefore cannot present the daily stations of the moon, as the Hindu divisions do. They are measured on the equator rather than on the ecliptic. According to G. Schlegel,[2] there is no connexion at all between the Chinese asterisms and the lunar zodiac. Some of the names of the 28 *siüs* were known to the Chinese as early as the time of the emperor Yaou (2356 B.C.), while the earliest Babylonian record concerning the lunar mansions and the earliest Hindu record of the *nakṣatras* named after the Vedic deities are much later than that.[3]

The *nakṣatras*, in their recent forms at least, are apparently assimilated to the Chinese *siüs*, and the whole system of junction stars is undoubtedly an imitation of them.[4]

J. B. Biot and his son were the first to demonstrate the identity of the Chinese *siüs* and the 28 lunar mansions of the Hindus and Arabs. They concluded that this arrangement of celestial divisions was invented by the Chinese and borrowed from them by the Hindus and Arabs for purely astrological purposes.

'To this day,' says J. J. M. de Groot, 'no considerations of importance have cancelled these views [of Biot], and though they have been rigorously combated by Weber, Max Müller, and other authorities of renown, yet it seems that most investigations of oriental astronomy silently subscribe to them.'[5]

2. The twelve kungs.—Besides the division of the lunar cycle into 28 unequal mansions, the Chinese, in common with the Hindus and Western nations, divide the zodiac into twelve equal parts as follows:

(1) Ta Liang, Aries-Taurus; (2) Hsi Chen, Taurus-Gemini; (3) Tsun Hseo, Gemini-Cancer; (4) Tsun Go, Cancer-Leo; (5) Tsun Vi, Leo-Virgo; (6) Hseo Sing, Virgo-Libra; (7) Ta Ho, Libra-Scorpio; (8) Ssi Mu, Scorpio-Sagittarius; (9) Sing Ki, Sagittarius-Capricorn; (10) Hnan Hio, Capricorn-Aquarius; (11) Tsu Tsu, Aquarius-Pisces; (12) Hiang Lo, Pisces-Aries.

These names are found in Chinese books written several centuries B.C.—*e.g.*, *Tso Tsuan*, *Êrh Ya*, etc. The Hindu zodiac signs, which are probably of Greek origin, entered China at a much later date.

3. The four quarters and the five kungs.—The Chinese divide the heavens into four quarters. The eastern quarter is called Tsang Lung ('the Blue Dragon') and is associated for astrological purposes with the season of spring, the planet Jupiter, the element wood, the colour blue, the taste sour, and the virtue of benevolence. The southern quarter is called Chü Niaou ('the Red Bird') and is associated with the season of summer, the planet Mars, the element fire, the colour red, the taste bitter, and the virtue of propriety. The western quarter is called Pe Hwu ('the White Tiger') and is associated with the season of autumn, the planet Venus, the element metal, the colour white, the taste hot, and the virtue of righteousness. The northern quarter is called Hsüan Wu ('the Black Warrior,' or 'the Black Tortoise,' as it has also been interpreted) and is associated with the season of winter, the planet Mercury, the element water, the colour black, the taste salt, and the virtue of wisdom.

In Ssŭ Ma Chien's *Ssŭ Ki* the stars are divided into five *kungs*, or palaces—middle palace, eastern palace, southern palace, western palace, and northern palace. The middle palace consists of the northern circumpolar stars, and the other four are like the four quarters stated above. This system of division is followed by Pan Ku in his *History of the Later Han Dynasty*.

4. The three yuans and the two kuans.—The three *yuans* (palaces or stellar spaces) are (1) Tsu Vi Yuan (the Middle Palace), consisting of the northern circumpolar stars, (2) Tai Vi Yuan (the Upper Palace), consisting of stars in Leo, Virgo, Corvus, etc., and (3) Tien Ssu Yuan (the Lower Palace), bounded by two chains comprising Hercules, the upper part of Ophiuchus, etc.

The two *kuans*, or kinds of officers, are (1) *tsung kuan*, the internal officers, consisting of groups of stars inside the equator, and (2) *wusi kuan*, the external officers, consisting of groups of stars outside the equator.

This system of the division of the heavens is peculiarly Chinese and is very ancient. In the *Tien Wun*, consisting of eight chapters, written by Wu Hian, an astronomer of the Yin (or Shang) dynasty (1766–1122 B.C.), the astronomer assigned to the Middle Palace four seats or officers, consisting of eight stars, to the Upper Palace one seat, consisting of one star, to the Lower Palace four seats, consisting of eight stars, to the internal officers five seats, consisting of 24 stars, and to the external officers nineteen seats, consisting of 93 stars. In the *Tien Wen Sing Chan*, written by Kan Te, an astronomer of the state of Tsi, and the *Tien Wen*, written by Hsi Hsen, an astronomer of the state of Wui (both astronomers lived about the 4th cent. B.C.), the method of division is identical with that of Wu Hian, but the numbers of officers and stars are greatly increased. Adding these estimates together, we get 283 officers, consisting of 1464 stars.

5. The three yuans and the 28 siüs.—There is a

[1] *Journ. of the British Astronomical Association*, xix. 337-345.
[2] *Uranographie chinoise*, The Hague, 1875.
[3] *Observatory*, xxxii. [1909] 187.
[4] According to Agnes M. Clerke's art. 'Zodiac' in *EBr*11, the *siüs* were of Chinese invention and the *manāzils* were of Indian derivation. The *nakṣatras* in their recent organization were, as far as possible, assimilated to the Chinese *siüs*. 'The whole system of junction stars,' she says, 'was doubtless an imitation of the *sieu*; the choice of them by the Hindu astronomers of the 6th century A.D. was plainly instigated by a consideration of the Chinese, compiled with a widely different intent.'
[5] *The Religious System of China*, Leyden, 1892-1910, bk. i. vol. iii. p. 974, footnote.

popular book consisting of 31 songs by Tan Yuan Tsu of the Sui dynasty (589–617), called *Pu Tuen Ko*. It divides the stars into three *yuans* and 28 *siüs*. There are in all 193 *kuans*, or officers, consisting of 1457 stars. The stars which have been named by the Chinese are not many more than this, except in the book of Chang Heng, which gave 320 *kuans*, consisting of 2500 stars, and, besides these, 11,520 stars. This system of division is followed by Ma Twan Lin and others.

IV. *THE RELIGIOUS ASPECTS.*—**1. Animistic view.**—The animistic view which the Chinese took of many things in nature is seen in their attitude to the sun, moon, and stars. Many of them regard the heavenly bodies not as merely inanimate bodies, but as dwelling-places of spiritual beings or as spiritual beings themselves; *e.g.*, there is, it is said, a cock in the sun and a hare in the moon, the palace of angels; the hare is said to be sitting under a tree pounding medicine in a mortar. Those spiritual beings have superhuman powers, though the supreme power is not attributed to any of them, but to *Tien*, *Shang-ti*, or God alone. Hence the movements and appearances of the heavenly bodies are not regarded as mechanical, lifeless, or inevitable, for within or behind them there is a will which causes them. This will may be the will of the heavenly bodies, of the spiritual beings who dwell in them, or of God, the Supreme Ruler.

2. Comparison of the heavens with the earth.—In the heavens there are the sun and the moon; correspondingly on the earth there are the *yang* and the *yin*, the two contrary conceptions applied to phenomena mental and moral as well as physical. *Yang* is the male principle, associated with heat, day, etc., and *yin* is the female principle, associated with cold, night, etc. Hence the sun is called 'the great *yang*,' and the moon 'the great *yin*.' It is also said that the sun is 'the crystallization of the *yang*' and the moon 'the crystallization of the *yin*.' The five planets are said to correspond to the five elements of the earth, and therefore Mars is called 'the planet of fire,' Mercury 'the planet of water,' Venus 'the planet of metal,' Jupiter 'the planet of wood,' and Saturn 'the planet of earth.' Similarly, the different stars and constellations are believed to correspond to the various portions of the surface of the earth. In the chapter called *Tien Kwan* ('The Heavenly Officers') in Ssŭ Ma Chien's *Ssŭ-Ki*, in which all the beliefs mentioned above may be found, we read: 'The twenty-eight *siü* or constellations correspond to the twelve *chows*, or provinces. . . . The source of this (saying or belief) is of remote antiquity indeed.'

It is a popular saying in China that 'the stars of the heavens above and the configurations of the earth beneath correspond with each other.' A great number of stars—*e.g.*, the twenty stars constituting the two chains of the Tien Ssu Yuan, or the Lower Palace—are believed to correspond to certain countries in China and are given the names of those countries.

In some of the ancient books the heavens are said to be spherical and the earth square, the heavens dynamic and the earth static. There are also ancient stories or mythologies which represent the heavens as having a hollow place in the north-west round which all the stars revolve, and the earth as having a hollow place in the south-east towards which all the waters run.

3. Comparison of the heavenly bodies with men.—Heaven, earth, and men are believed to be the three great powers or genii in the universe. The heavenly bodies are regarded not merely as separate individuals, but as having a society like that of men. As the Chinese state was an empire, so the heavenly society was believed to be an empire. This can be observed in the names of the stars. The coining of significant poetical or mythological names for the heavenly bodies was probably to render easier the task of discriminating and remembering them. Many stories grew round those names, which are regarded by some as fables and by others as true. According to the names of the stars in the Tai Vi Yuan, the Upper Palace, the northern polar star (Polaris) is where the emperor is. The reason is quite plain, as Confucius said: 'He who exercises government by means of his virtue is like the northern polar star, which keeps its place, and all the other stars turn towards it.'[1] The Great Bear, or the Spoon, as it is called in China, is said to be the imperial chariot, and its motion round the northern polar star is said to be the emperor viewing his empire in all directions. Names of some of the other stars are: the Empress's Palace, Crown Prince, Prince, Princess, Guards, Civil and Military Officers, Law-Court, Prison, Armoury, Storehouse, Kitchen, Bed, Canopy, etc.

4. Relation between the heavenly and the earthly empires.—These two empires are not separated from one another without inter-communication. *Tien*, or *Shang-ti*, the Supreme Ruler, governs both, but the heavenly one more directly. The ruler of the earthly empire used to be called Tien-tsu, 'the son of Tien (or God).' Enthronement used to be regarded as the appointment of God, the rewarder of the good and the punisher of the bad. Therefore, when the Son of Heaven was good and his empire well governed, auspicious phenomena used to appear from God in the heavens, and, when he was bad and his empire in disorder, threats used to appear. There are many heavenly phenomena which are regarded as God's threats—notably eclipses. The *Canon of Odes* refers to an eclipse of the sun of the date 29th Aug. 775 B.C., which was carefully verified by John Chalmers.

'The sun was eclipsed—
A thing of very evil omen,
First the moon looked small,
And then the sun looked small,
Henceforth the people
Will be pitiable indeed.
The sun and moon presage evil
By not keeping to their proper paths;
All through the kingdom there is no [good] government.
Because good men are not employed.
For the moon to be eclipsed
Is a small matter,
But now the sun is eclipsed,
How dreadful is that!'

In the Confucian classic called *Tsun Tsiu* ('Springs and Autumns') the eclipse of the sun which took place on 20th April 610 B.C. is recorded. The writer says:

'On the occasion of an eclipse of the sun, the Son of Heaven should not have his table spread so lavishly as usual, and should have drums beaten at the altar to the spirits of the land, while the feudal princes should present offerings of silk to the spirits of the land and have drums beaten at their courts, thus manifesting their own service of the spirits and so teaching the people to serve their rulers, according to the respective rights of each, as was customary in ancient days.'

The word 'eclipse' used here is the same as the word 'eat.' The eclipse of the sun or the moon is described, in some of the Chinese stories, as the sun or moon being eaten by a certain animal, and the beating of drums is said to frighten the animal away.

The sun in the heavens is also said to correspond to the ruler on the earth; *e.g.*, when the people wished the death of Kie, the tyrant (reigned 1818–1753 B.C.), they said: 'O sun, why expirest thou not? Let us die together with thee.' Therefore the eclipse of the sun is generally regarded as a threat from God to the emperor. There are

[1] *Analects*, bk. ii. ch. 1.

numerous examples, and the edict of the emperor Ming Ti (A.D. 227–239) after the eclipse of the sun in 233 is most illuminating:

'We have heard,' says the emperor, 'that if a sovereign is remiss in government, God terrifies him by calamities and portents. These are divine reprimands sent to recall him to a sense of duty. Thus, eclipses of the sun and moon are manifest warnings that the rod of empire is not wielded aright. Ever since We ascended the throne, Our inability to continue the glorious traditions of Our departed ancestors and carry on the great work of civilization has now culminated in a warning message from on high. It therefore behoves Us to issue commands for personal reformation, in order to avert impending calamity. The relationship, however, between God and man is that of father and son; and a Father, about to chastise his son, would not be deterred were the latter to present him with a dish of meat. We do not therefore consider it a part of Our duty to act in accordance with certain memorials advising that the Grand Astrologer be instructed to offer up sacrifices on this occasion. Do ye governors of districts, and other high officers of State, seek rather to rectify your own hearts; and if anyone can devise means to make up for Our shortcomings, let him submit his proposals to the throne.'[1]

Comets, even more than eclipses, are regarded as God's threats. When the comets appeared in 524 B.C., travelling eastward towards the Milky Way, an officer said: 'This is a broom to sweep away the old, and give us new. God often makes us such signs. The feudal princes will suffer from calamities by fire.'[2] The stars or the spiritual beings who dwell in them sometimes descend from the heavens, either by themselves or by the will of God, are born on earth, and go back to their positions in heaven after their earthly life.

In *The Annals of the Bamboo Books* there are the following legends:

'He's mother (the mother of Hwang Ti, 2968 B.C.) was called Tu Paon. She witnessed a great flash of lightning, which surrounded the star Chu (or Duhhe) of the Great Bear with a brightness that lighted all the country about her, and thereupon became pregnant.'

'His mother was called Niu Tsie. She witnessed a star like a rainbow come floating down the stream to the islet of Hwa. Thereafter she dreamed and received it, and was moved in her mind, and bore *Shaon-Haon* [the emperor Che, 2597 B.C.].'

'His mother was called Niu Chu. She witnessed the *Yaou Kwang* star (or Bemtuash) go through the moon like a rainbow, when it moved herself in the palace of Yio-Fang, after which she brought forth *Tsun Hu* [the emperor, 2513 B.C.].'

'His mother was called *Sis-Ki*. She saw a falling star which went through the constellation Maou, and in her dream her thoughts were moved till she became pregnant, after which she swallowed a spirit's pearl, . . . and gave birth to *Yu* (king 2205 B.C.) in Shih Nio.'

There are 28 heroes in Chinese history who were believed to be the 28 *siüs*, or constellations, descended. A great man on earth may become after death a spiritual being in heaven and dwell in one of the stars. Some stars are named after historical heroes. There are a great many stories, love stories, and mythologies based upon beliefs of this kind.

5. Sacrifices.—We read in the 22nd book called *Ki Tung* ('The Foundation of Sacrifices') of the *Li Ki* ('The Book of Rites'), a collection of treatises on the rules of propriety or ceremonial usages, one of the five Confucian books or canons:

'Of all the methods for the good ordering of men, there is none more urgent than the use of ceremonies. Ceremonies are of five kinds, and there is none of them more important than sacrifices.'[3]

Among various sacrifices there are sacrifices to the sun, moon, and stars. We do not know when these rites began, but they have been performed under each dynasty from the 23rd cent. B.C. down to the time of the present Republic of China. In the 20th book of *Li Ki*, called *Ki Fâ* ('The Laws of Sacrifices'), it is said:

'With a blazing pile of wood on the Grand altar they [the Emperors, from Emperor Shun 2255 B.C. to King Wu 1122 B.C.] sacrificed to Heaven;[4] by burying (the victim) in the Grand mound, they sacrificed to the Earth. (In both cases) they used a red victim.[1]

By burying a sheep and a pig at the (altar of) Great brightness, they sacrificed to the seasons. (With similar) victims they sacrificed to (the spirits of) cold and heat, at the pit and the altar, using prayers of deprecation and petition; to the sun, at the (altar called the) royal palace; to the moon, at the (pit called the) light of night; to the stars at the honoured place of gloom; to (the spirits of) flood and drought at the honoured altar of rain; to the (spirits of the) four quarters at the place of the four pits and altars; mountains, forests, streams, valleys, hills, and mounds, which are able to produce clouds, and occasion winds and rain, were all regarded as (dominated by) spirits.'[2]

In the 21st book of *Li Ki*, called *Ki Î* ('The Meaning of Sacrifices'), it says:

'The sacrifice in the suburb of the capital was the great expression of gratitude to Heaven, and it was specially addressed to the sun, with which the moon was associated. The sovereigns of Hsiâ [dynasty, 2205–1766 B.C.] presented it in the dark. Under the Yin dynasty [1766–1122 B.C.] they did so at noon. Under the Kau [dynasty, 1122–255 B.C.] they sacrificed all the day, especially at daybreak, and towards evening.

They sacrificed to the sun on the altar, and to the moon in the hollow;—to mark the distinction between (the) gloom (of the one) and (the) brightness (of the other), and to show the difference between the high and the low. They sacrificed to the sun in the east, and to the moon in the west;—to mark the distinction between (the) forthcoming (of the former) and (the) withdrawing (of the latter), and to show the correctness of their (relative) position. The sun comes forth from the east, and the moon appears in the west; the darkness and the light are now long, now short; when the one ends, the other begins, in regular succession:—thus producing the harmony of all under the sky.'[3]

These are the sacrifices at the equinoxes; that to the sun at the vernal equinox in the eastern suburb, and that to the moon at the autumnal equinox in the western suburb. These had been performed under each dynasty, and can also be found in *Ta Tsing Tung Li* ('The Ritual of the Manchu Dynasty'). The former is called *Chow Zi*, 'The Morning Sun,' and the latter *Si Yüe*, 'The Evening Moon.'

In the dynasty of Chin (255–206 B.C.) they sacrificed to what they called the eight gods, *i.e.* the god of the heavens, the god of the earth, the god of war, the god of the *yin*, the god of the *yang*, the god of the sun, the god of the moon, and the god of the four seasons. In *Han Shu* ('the Book [or History] of the early Han Dynasty') [206 B.C.–A.D. 25] it is said: 'There were such eight gods in the ancient times, but their origin is unknown.'

In the dynasties after the China dynasty different temples were built for their sacrifices. Even at the present day temples connected with the sun, moon, and stars can be found in different places. In Peking there is the world-famous Tien Tan ('Temple of Heaven'), and in it there are altars of the sun, of the moon, of the 28 constellations, and of some other stars and groups of stars. In the Manchu dynasty (1644–1911) sacrifices were offered in the Temple of Heaven once every spring and once every autumn. Even since the establishment of the Republic of China (1911), a grand sacrifice was offered in the Temple of Heaven by Yuan Shi Kai, the first Chinese President.

The 15th of the eighth lunar month is a Chinese holiday called *Tsung Tsiu Tse* ('the mid-autumn holiday'). The moon is said to be always at its fullest and brightest on this evening if it is visible, whereas this need not be so on the same date of other lunar months. A family festival used to be, and in some places still is, held in Chinese houses on that evening. The offerings to the moon consist chiefly of fruits, and the ceremony is similar to that of Chinese ancestor-worship. On this holiday schools, shops, etc., are closed, and farmers cease work for a few days. Relatives and friends exchange presents, chiefly

[1] H. A. Giles, *Confucianism and its Rivals*, London, 1915, p. 180.

[2] *Ib.* p. 53.

[3] Tr. J. Legge in *The Sacred Books of China*, pt. iv. (*SBE* xxviii. [1885] 236).

[4] On the blazing pile were placed the victim and pieces of jade; in the square mound were buried the victim and pieces of silk.

[1] Red was the special colour of victims under the Chow dynasty.

[2] *SBE* xxviii. 202 f. [3] *Ib.* p. 218 f.

eatables, and invite each other to dinner on one or more of the days following the mid-autumn holiday.

With regard to the sacrifices to the stars we read in *Urh Ya*, an ancient dictionary, one of the Thirteen Confucian Classics: 'The sacrifice to the stars is called Pu.' Even in our day tablets of stars can be found in public temples and private houses in different provinces.

6. Significance or purpose of sacrifices.—The significance of these sacrifices is not merely religious, nor is their religious significance always the most prominent. Sometimes these rites were used for political purposes by the rulers. This is the case not only in ancient times; there was a time in our present century when *Shinkio Riyo Mondai* ('The Problem of the Utilization of Religions') was of great interest to statesmen and politicians in Japan, and the political significance of the sacrifices at the Temple of Heaven performed by Yuan Shi Kai was sufficiently obvious. When the sacrifices are performed by the people, their purpose is sometimes social as well as religious. In any case the idea of keeping up the custom seems to play a great part. Western scholars are apt to take these sacrifices purely as the expression of religious faith and devotion. The following passages in *Lî Kî* may show that they are not always so.

As sacrifices are the most important of ceremonies or rites, let us first indicate the purposes for which they are offered.

'The rites to be observed by all under heaven were intended to promote the return (of the mind) to the beginning (=Creator of all); to promote (the honouring of) spiritual Beings; to promote the harmonious use (of all resources and appliances) of government; to promote righteousness; and to promote humility. They promote the return to the beginning, securing the due consideration of their originator. They promote (the honouring) of spiritual Beings, securing the giving honour to superiors. They promote the (proper) use of all resources, thereby establishing the regulations (for the well-being of) the people. They promote righteousness, and thus there are no oppositions and conflictings between high and low. They promote humility, in order to prevent occasions of strife. Let these five things be united through the rites for the regulation of all under heaven, and though there may be some extravagant and perverse who are not kept in order, they will be few.'[1]

There are two other passages, one of which indicates the objects to whom sacrifices should be offered and the other the purposes of the sacrifices.

'According to the institutes of the sage kings about sacrifices, sacrifice should be offered to him who had given (good) laws to the people; to him who had laboured to the death in the discharge of his duties; to him who had strengthened the state by his laborious toil; to him who had boldly and successfully met great calamities; and to him who had warded off great evils.'[2]

'Sacrifices were for the purposes of prayer, or of thanksgiving, or of deprecation.'[3]

The sun, moon, and stars fall under none of the above five classes except that in later dynasties some stars were sacrificed to for the power of warding off evils. With regard to the three purposes that of thanksgiving seems to be the sole motive for which the Chinese sacrificed to the sun, moon, and stars.

The Chinese were grateful to the sun, moon, and stars, and expressed their gratitude by means of sacrifices, because, says a passage: 'As to the sun and moon, the stars and constellations, the people look up to them.'[4] The phrase 'look up to' (*jan yang*) in this case has an ethical meaning, as when we speak of looking up to a great man with a view to modelling our behaviour on his. The Chinese believed that they could adjust their conduct by observing the appearances and movements of the heavenly bodies, which were regarded as God's revelation.

[1] *Lî Kî*, xxi. i. 20 (*SBE* xxviii. 219 f.).
[2] *Ib.* xx. 9 (*SBE* xxviii. 207 f.).
[3] *Lî Kî*, ix. iii. 28, in *Sacred Books of China*, pt. iii. (*SBE* xxvii. [1885] 448.
[4] *Lî Kî*, xx. 9 (*SBE* xxviii. 209).

There seem to be other reasons why the Chinese should be grateful to the sun, moon, and stars—especially to the sun for its great and various benefits—but the fact is that they attribute these benefits to *Tien*, God, rather than to the heavenly bodies themselves. Indeed their sacrifices to these bodies are sometimes an indirect way of expressing their gratitude to God.

7. Sun-worship, moon-worship, and star-worship.—Is there, or has there been, sun-worship, moon-worship or star-worship in China? The answer to this question depends upon what we mean by the term 'worship.' If by worship we mean the 'adoration, sacrifice, praise, prayer, thanksgiving, or other devotional acts performed in honour of the Supreme Being or God,'[1] it is certain that there is no such worship in China, and perhaps also that such worship has never existed there. None of the heavenly bodies is conceived by the Chinese as the Supreme Being. The Supreme Being is, for them, *Tien*, God, and God only. Nor can we find such worship in China if we take the term 'worship' to mean (1) the 'prostration which arises in presence of a superior being on whom we are absolutely dependent and whom we fear or reverence,' or (2) 'the feeling and act of worship' which 'involves primarily submission and fealty,' and 'is the attitude of the weak to the strong on whom they are absolutely dependent.'[2] The Chinese do not regard themselves as absolutely dependent on any of the heavenly bodies or on the spirits dwelling in them, but they regard the heavenly bodies or their indwelling spirits as dependent on *Tien*, 'God,' as they themselves are. It is true that they believe these heavenly bodies to possess powers which do not belong to men, but they also believe that men have powers which these bodies do not possess. What is more, some of them believe that certain men have the power of subjugating the spirits of the heavenly bodies, as magicians have the power of controlling spirits.

There are certain passages which have been regarded as evidence of sun-worship in China. In the 9th book of *Lî Kî*, called *Kiâo Teh Sĕng* ('The Single Victim at the Border Sacrifices'), a passage says:

'At the (Great) border sacrifice he [the Son of Heaven] welcomed the arrival of the longest day. It was a great act of thanksgiving to Heaven, and the sun was the chief object considered in it.'

Legge, commenting on this, says:

'The sun became for the time the "spirit-tablet" of Heaven. Fang Küeh says: "(The Son of Heaven) was welcoming the arrival of the longest day, and therefore he regarded the sun as the residence (for the time) of the spirit of Heaven. That spirit could not be seen; what could be looked up to and beheld were only the sun, moon, and stars."'[3]

The present writer need not give his own translation here, but he must point out that the idea that the sun was regarded as the residence of the spirit of Heaven is not implied either in Fang Küeh's commentary or in the text.

With reference to the passage in the book[4] on the meaning of sacrifices, namely:

'The sacrifice in the suburb of the capital was the great expression of the gratitude to Heaven, and it was specially addressed to the sun, with which the moon was associated,'

Khân Hâo, a Chinese commentator, says, according to Legge:

'Heaven is the great source of tâo (the course of nature and duty), and of all the visible bodies which it hangs out, there are none greater than the sun and moon. Therefore, while the object of the suburban sacrifice was a grateful acknowledgment of Heaven, the sun was chosen as the resting-place for its spirit (or spirits). The idea in the institution of the rite was deep and far-reaching.'[5]

[1] *The Century Dictionary of the English Language*, London, 1889, *s.v.* 'Worship.'
[2] *DPhP* ii. 822.
[3] *SBE* xxvii. 427, n. 1.
[4] *Lî Kî*, xxi. i. 18.
[5] *SBE* xxviii. 218, n. 2.

The same remark may be made on the translation of this passage, viz. that there is neither in the text nor in the commentary the idea that the sun was chosen as the resting-place of the spirit (or spirits). The ultimate purpose in both these cases was to express gratitude by means of sacrifices to Heaven, but not to the sun or the spirit of the sun. Heaven is invisible, and they thought that for the object of sacrifice something visible was required. Therefore the sun was chosen as a symbol. Neither of these two cases therefore can be regarded as an example of sun-worship. There does not seem to be any other case. Legge says concerning the last example :

'It must be borne in mind that the rites described in the text are those of former dynasties, especially of that of Kâu. I cannot bring to mind any passages in which there is mention made of any sacrifice to the sun or sun-spirit in connexion with the great sacrifice to Heaven, or Shang Tî, at the service on the day of the winter solstice in the southern suburb.'[1]

Hence it is only by taking the term 'worship' in a very comprehensive sense, and by ignoring the purpose of the sacrifices, that we may say that the fact that the Chinese sacrificed to the sun implies that they worshipped it. It is the same with regard to their worship of the moon and the stars. In whatever sense we may be justified in saying that some of the Chinese worshipped the sun, moon, and stars, such worship occupies a very insignificant position in China compared with the worship of other natural phenomena or the spirits of them. If by sun-worshipper, moon-worshipper, etc., we mean one who regards the sun or the moon as the only or the supreme object of worship, we may say with conviction that the Chinese are not, as they have never been, sun-worshippers, moon-worshippers, or star-worshippers.

LITERATURE.—See the works quoted in the footnotes.

T. FU.

SUN, MOON, AND STARS (Hebrew).—The Hebrew conception of the universe, as we find it in the OT, is not scientific in the modern sense of the term. The cosmology of the Hebrews (see art. COSMOLOGY [Hebrew]) is characterized by the simplicity and *naïveté* of primitive folk. The attitude of mind is one of awe and wonder, not of critical inquiry; and to pry closely into the secrets of the divine government is felt to indicate a want of reverence, and even to be dangerous. Moreover, it would be natural to a people which seems to have had an innate genius for religion to think, even after it had progressed beyond the stage of quite primitive ideas of the universe, that religion itself constituted the whole of true science or knowledge.[2] We need not expect, therefore, to find in the OT any inkling of the modern science of astronomy. The Hebrew shepherds without doubt, like the Phœnician mariners (cf. Pliny, *HN* vii. 57), closely observed the sky, and learned from the scrutiny many lessons of practical value for their every-day life. It is equally likely that at an early date the Hebrews were wont to worship the stars and planets. There are later traces of this worship in the OT (cf. 2 K 17[16]).[3] And, besides this, the figures suggested by various constellations no doubt gave rise to a number of curious fables and fancies. On the other hand, the OT, as we have it, a collection of much-edited writings, preserves few traces of the astronomical and astrological lore of the Hebrews themselves. Since in the course of their national development the study of the stars and planets became more and more associated with the idolatrous practices of surrounding nations, later editors would be anxious to avoid, or even to remove, references to astronomy and astrology (cf. Dt 18[10]). This would account for the fact that most of the references preserved in the OT are of a very general nature.

The chief planets are, of course, alluded to frequently. The sun (*shemesh*) is spoken of as ruling by day (Ps 136[8]), and is often referred to as coming forth (from one chamber) in the morning and going in (to another chamber) in the evening. Its magnificence (Jg 5[31]) and its wonderful power for good (Dt 33[14]) or for evil (2 K 4[18f.]; cf. Ps 121[6]) impressed the Hebrews, as they have impressed all peoples. Jahweh Elohim Himself might be compared to a sun (Ps 84[11]).[1] There are four words for 'moon' in the OT. *Yārēaḥ* is used especially in poetry (Gn 37[9], Jos 10[12] etc.). To this word is closely related one of the words for 'month,' *yéraḥ*, a word which is common to all the Semitic languages, though not in frequent use in the OT. Another word, *lebhānāh*, which occurs only three times (Ca 6[10], Is 24[23] 30[26]), designates the moon as the 'white one' or the 'pale one.' Rarer still is a word *kese'* (perhaps connected with the Assyr. *kusê'u*, 'headdress' or 'cap'), which denotes the full moon (perhaps the moon-god clothed in the splendour of his tiara).[2] The most common word is *ḥōdesh*, which means 'new moon,' and also 'month.' Thus the new moon was regarded as marking a new period or month, and the use of *yārēaḥ*, *yeraḥ*, and *ḥōdesh* for both moon and month shows that among the Hebrews the month and year were lunar. The moon rules the night (Ps 136[9]), and, like the sun, is a power for good (Dt 33[14]) or for evil (Ps 121[6]). Its pale brilliance made it the emblem of beauty (Ca 6[10]). In a few passages reference seems to be made to eclipses (Am 8[9], Is 38[8], Job 9[7] etc.). And we are once told that 'the sun stood still, and the moon stayed, until the nation had avenged itself on its enemies'[3] (Jos 10[12f.]). In late writings there are several allusions to the worship of the sun (Ezk 8[16f.], Job 31[26f.]; cf. 2 K 23[5]) and moon (Dt 4[19]).

Other planets are mentioned more incidentally. Thus, in all probability, Venus[4] as the Morning Star is referred to in Is 14[12] under the name הֵילֵל, *hêlēl*, or הֵילֶל, *hêlāl* (lit. 'the glittering one'), though it should be mentioned that some expositors have seen in the term an Arabic name for the moon (هِلَال, *hilâl*). W. Lotz (*PRE*[3], *s.v.* 'Sterne') indeed argues that the Arabic word means 'new moon,' which would be unsuitable;

as we find among the ancient Egyptians, Babylonians, Assyrians, and Persians. But the present writer has pointed out (*Journal of the Manch. Egyptian and Oriental Society*, 1917, pp. 67–70) that the word usually translated 'wings' will bear another meaning. The meaning may be 'skirts' rather than 'wings,' and the figure that of the glorious robe that flows from the sun.

[1] In Jg 14[18], Job 9[7] the word translated 'sun' is not *shemesh*, but *heres* (cf. Is 19[18], and the place-names in Jg 1[35] 8[13]). It is probable that in Jg 14[18] the text is corrupt.

[2] The name Sioai is probably derived from Sin, the name of the moon-god in Babyloniao. In Ex 3[1] Sinai is described as 'the mountain of Elohim,' *i.e.* the sacred mountain. This suggests that it had long been sacred.

[3] The writer clearly intends a miracle to be understood (so C. Steuernagel in Nowack's *Handkommentar*, 1899). Other expositors (*e.g.* W. H. Bennett in 'Joshua,' *SBOT*, 1899) regard the passage as poetic and figurative (cf. Jg 5[20]).

[4] Another designation of Venus is *meleketh ha-shâmayim* מֶלֶכֶת הַשָּׁמַיִם, 'the queen of heaven,' mention being made of cakes which were baked for her (Jer 7[18] 44[17. 25]).

[1] *SBE* xxviii. 218, n. 2.

[2] On this point Laurie Magnus's '*Religio Laici*' *Judaica* (1907) will be found suggestive. It has been argued elsewhere (W. Jay Hudson, *Law of Psychic Phenomena*[10], 1907) that ignorance of, or indifference to, what we term science might co-exist with a perfect knowledge of the laws of the moral and spiritual life.

[3] It is quite unnecessary to suppose that the idea of worshipping the stars and planets was borrowed, though, of course, the Hebrews came more and more into contact with people who were addicted to this worship. Whether and to what extent they came under direct Babylonian and Egyptian influence is a disputed matter (see K. Marti, *Religion of the OT*, p. 36 ff.). Cf. the proper names שִׁמְשׁוֹן (Jg 13[24]) and שִׁמְשַׁי (Ezr 4[8]), derived from שֶׁמֶשׁ, 'sun'; the Palmyrene יַרְחַי, and the Biblical יְרֵחוֹ, Jericho, derived from יָרֵחַ, 'moon.' Cf. also Beth-shemesh, a place sacred to the sun-god. Commentators have seen in Mal 3[20] (4[2]) the conception of a winged solar disk such

but, according to Zimmern and Buhl's edition of Gesenius's *Lexicon* (*Handwörterbuch*[14], 1905) it can denote the old moon as crescent.[1] Further, in Am 5[26] we probably have an allusion to Saturn (סִכּוּת, *sikkuth* = סַכּוּת, *sakkuth* = Assyr. *sakkut*; and כִּיּוּן, *kiyyun* = כַּיָּן, *kêvān* = Assyr. *kaivânu*).

The stars, again, are alluded to frequently in a general way; but there are a few references to particular stars or constellations, and these require special attention. The earliest of them is found in Am 5[8]. Since, however, the same terms occur, with others, in passages in the late book of Job which contain more precise references to astronomy, it is best to consider the Job passages first.

In Job 9[9], in a description of God's almighty power as manifested in the marvels of the material world, Job is represented as pointing to God as one

'Who shaketh the earth out of her place,
and the pillars thereof tremble.
Who commandeth the sun, and it riseth not;
and sealeth up the stars.
Who alone spreadeth out the heavens,
and treadeth upon the waves of the sea.
Who maketh *'āsh*, *kĕsīl*,
and *kīmāh* and the chambers of the south.'

The context indicates that the terms in the last two lines (עָשׁ, *'āsh*; כְּסִיל, *kĕsīl*; כִּימָה, *kīmāh*; חַדְרֵי תֵמָן, *ḥadrê têmān*) designate particular stars or constellations. We are helped, too, by the fact that three of them occur again (*kīmāh* in Am 5[8], Job 38[31]; *kĕsīl* in Am 5[8], Is 13[10], Job 38[31]; *'ayish* = *'āsh* in Job 38[32]); but there is considerable uncertainty as to the correct interpretation of some at least of the terms.

1. עָשׁ, *'āsh*, or better עָיִשׁ, *'ayish*, as in Job 38[32], and better still עָיְשׁ, *'ăyush*, as suggested by the Syriac (Pesh. עיתא). In Job 9[9] LXX has Ἔσπερος, Vulg. 'Hyades'; in Job 38[32] LXX Ἔσπερος, Vulg. 'Vesper.' Modern expositors have found in the word either the Great Bear, the Pleiades, Hyades, or the Northern and Southern Crown. *'Āsh* in Job 9[9] has to be taken in connexion with the other passage, 38[32], in which, according to the Massoretic text, it is said: 'or dost thou guide *'ayish* with her young?' (עִיש עַל־בְּנֶיהָ תנחם).[2] It is noteworthy, too, that what in Arabic corresponds to the Great Bear is called *na'sh*, 'the bier,' and that the three tail stars of Ursa Major are called *banāt na'sh*, 'children of the bier' (*i.e.*, in this case, 'mourners'). It is true that no philological connexion can be established between the two words, but the Arabic phrase 'children (or daughters) of the bier' is suggestive as regards *'ayish* and her children. It might seem natural to expect to find a striking constellation like the Great Bear mentioned in Job 9, and it would be fitting that it should be assigned the first place, though it may be mentioned in passing that possibly the Hebrews thought of this constellation not as a Great Bear, but as a lioness with her young (cf. with Ewald, Arabic *'ayuth*, and see A. Dillmann's Commentary). But there is some force in the argument that *'ayish* can hardly be Ursa Major, because the constellations in Job 38[31f.] are referred to on account of their meteorological importance. Some expositors, therefore (*e.g.*, M. A. Stern, Nöldeke, Schrader), have thought that *'ayish* represents the Pleiades. The great objection to this is that there is very good reason to think another Hebrew term (see below) designates that constellation. The 'children' of *'ayish* would certainly suit the Pleiades, which are sometimes represented as a hen with its chickens. But, on the other hand, the smaller stars surrounding or adjoining a star of the first magnitude might in several cases be described as its children. The Pleiades not being probable, some scholars agree with the Vulgate of Job 9[9] in thinking that *'ayish* represents the Hyades (so, *e.g.*, Hollmann, Schiaparelli); and this view has the support of the Syriac (Pesh. עיתא).[1] Moreover, the constellation is suitable as being one of great meteorological importance. Elsewhere in Hebrew *'āsh* means 'moth.' Friedrich Delitzsch has suggested that it may have the same meaning here, since the name 'moth' (*sâsu*) seems to have been given to a star by the Assyro-Babylonians (see T. G. Pinches, in Hastings' *DB*, *s.v.* 'Astronomy'). Now, the Hyades, a great red star of the first magnitude (Aldebaran) and five stars of the fourth magnitude, resemble our letter V or the Greek Δ. And Schiaparelli points out (p. 58) that in the butterfly stage, when the moth is at rest, 'its wings are not held detached from the body, as happens with most other butterflies, but spread themselves over it in such a way as to form a cloak, more or less similar (according to the several species into which the animal can be divided) to an isosceles triangle.' The suggestion is that to the author of the passages in Job *'āsh* meant 'moth,' which was a name for the Hyades. In that case, assuming the identity of *'āsh* and *'ayish*, the 'children' of *'ayish* would be the minor Hyades which surround Aldebaran. Against this it might be urged that it is easier to explain *'āsh* as short for *'ayish* than to account for *'āsh* as the original form, and that 'moth' does not seem a likely name for a constellation (especially the Hyades, apart from its form). The question of identification cannot be decided definitely. But, as the Pleiades has to be excluded (see below), there are reasons for thinking that either the Great Bear or the Hyades is intended. The Great Bear was no doubt as well known to the Hebrews as to other ancient peoples; but it would not be in the least surprising to find no mention of it in the OT, the references to astronomy being so few.

2. כְּסִיל, *kĕsīl*, usually translated 'fool.' In Job 9[9] LXX has Ἀρκτοῦρος, Vulg. 'Orion'; in 38[31] LXX Ὠρίων, Vulg. 'Arcturus'; in Am 5[8] LXX omits, Vulg. 'Orion'; in Is 13[10] (כְּסִילֵיהֶם, their '*kĕsīlīm*') LXX Ὠρίων, Vulg. 'splendor earum.' Some of the Rabbis of the Middle Ages (Saadya, Abulwalid, and others) identified the word with the Arabic *Suhail* and interpreted it in its later sense, Canopus. The preponderating view of the versions is in favour of Orion, a constellation which was popularly thought of as a giant who was bound in chains to the sky. *Kĕsīl* occurs elsewhere in Hebrew with the meaning 'dullard' or 'fool,' and modern expositors commonly think of the giant (Orion) as a fool in the sense of an impious person who had rebelled against God. But the Arabic equivalent of the root (كسل, *kasala*) means 'to be thick, plump,' which suggests that *kĕsīl* itself need not mean anything more than giant (the big, burly one); and, as Cheyne says (art. 'Orion' in *EBi*), *kĕsīl* ought not to be confounded with *nābāl* ('fool' in the sense of impious person). In Job 38[31] there seems to be a reference to some myth current among the Hebrews, the giant being spoken of as bound with cords; but what exactly the myth was is quite uncertain. In Am 5[8] *kīmāh* (see below) and *kĕsīl* are again mentioned together ('seek him that maketh *kīmāh* and *kĕsīl*, and turneth black darkness into morning,' etc.) as well as in Job 38[31] ('Dost thou bind the bands of *kīmāh*, or loose the cords of *kĕsīl*?'). Further, in Is 13[10] we find the curious expression 'their *kĕsīlīm*' (often translated 'the stars of

[1] P. Jensen, however, thinks (*JE*, *s.v.* 'Astronomy') that there is little ground for supposing that any star or planet is referred to; the reference in Isaiah is too vague.

[2] For תְּנַחֵם, however, it is better to read תְּנַחֵם ('and dost thou console *'ayish* for her children?'). See, further, below.

[1] It seems certain that the Syriac word does denote the Hyades or the chief star of the group (cf. Barhebræus).

heaven and the Orions thereof').[1] This seems to indicate that primarily *kĕsīlīm* was used to denote stars of the first magnitude, in distinction from lesser stars (*kōkābīm*). In any case it is pretty generally agreed that *kĕsīl* represents Orion. It is one of the most brilliant constellations, and did not fail to arrest the attention of the ancients.

3. כִּימָה, *kīmāh*, literally 'a group, cluster,' cognate with Arabic *kâma* (كام), 'to heap up.' In Job 9[9] LXX has Πλειάς, Vulg. 'Arcturus,' Pesh. and Targ. כִּימָא; in 38[31] the renderings of the Versions differ only to the extent that the Vulg. has 'Pleiades'; in Am 5[8] LXX omits, Vulg. has 'Arcturus,' Pesh. and Targ. כִּימָא. Most of the ancient authorities, in fact, understand the Pleiades by *kīmāh*. Several modern expositors, however, prefer to think of Sirius (*e.g.*, G. Hoffmann). But the word itself suggests that we are to look for a compact cluster of stars, and, of course, we must seek for one that early attracted attention. The Pleiades, as Schiaparelli says, is the best known of such clusters, 'and also the only one which has in consequence of its conspicuous light awakened universal attention at every time and among all peoples' (p. 62).[2] The expression 'the bands of *kīmāh*' in Job 38[32] is no doubt to be understood metaphorically.[3] The Arabic name for the Pleiades, *thurayya*, also means 'cluster,' and Bar Ali mentions it as an explanation of *kīmāh*. The word *kīmāh* itself has also been connected with the Arab. *kūmat*[un], 'house,' and the Assyr. *kimtu*, 'family.' In either case the name would suit the Pleiades.

It should be noted, further, that, according to some ideas found in the Talmud (*B*[e]*rakhōth*, 58*b*; *Rosh ha-shanah*, 11*b*), God brought the flood by causing *kīmāh* to set instead of rise in the morning, and by removing two stars from it. This is given as the explanation of Rabbi Joshua. According to R. Eliezer, the changes took place at a season when *kīmāh* is wont to set in the morning, and what God did was to make *kīmāh* rise in the morning on the day in question and lose two stars. This caused the flood. According to Stern, the dates mentioned suit exactly the morning rising and setting of the Pleiades, and seem to prove that in the time of Rabbi Joshua and Rabbi Eliezer (beginning of 2nd cent. A.D.) the Jews identified the Pleiades with *kīmāh*. It is further represented in the Talmud (*ib.*) that God afterwards set things right by taking away two stars from '*ayish* to diminish its rain-producing force.[4]

4. חַדְרֵי תֵמָן, *ḥadrê tēmān*, lit. 'chambers of the south.' The LXX renders ταμεῖα Νότου, Vulg. 'interiora Austri.' We seem to require mention of another definite constellation. This has given rise to the suggestion that the phrase designates the bright star Canopus or the constellation to which it belongs (so Stern). Other expositors regard the text as corrupt, and, emending חדר וְתֵמָן, see in the first word some uncertain constellation, and in the second (תאמָן=תֵמָן) Gemini, 'the Twins.' But we are not obliged to find in *ḥadrê tēmān* a special constellation. 'Chambers (or store-houses) of the South' might, as K. Budde says ('Hiob,' in W. Nowack's *Handkomm. zum AT*, 1896), denote a whole group of constellations in the southern sky. Dillmann (*loc. cit.*) thinks that the author of Job cannot have known anything of the stars of the southern hemisphere, but that it was known to him, as one who had travelled, that the farther one goes south the more stars and constellations become visible. To those who dwelt in the north these were, so to say, enclosed in the inmost chambers of the vault of heaven, and were therefore invisible. This would explain the expression 'treasure-houses of the South' (cf. Pr 24[4]; Job 37[9]). The word *ḥeder*, coming from a root meaning literally 'to conceal,' in the plural would bear the meaning 'penetralia.'[1] Schiaparelli gives reasons for thinking that the reference is to the imposing constellation found on the charts of to-day 'distributed between Argo, the Southern Cross, and the Centaur'; but whether this was visible to the author of Job depends upon the date of the book, which is uncertain.

In Job 38[31f.] we find another difficult astronomical term. The passage is as follows:

'Dost thou bind the bands of *kīmāh*,
or loose the cords of *kĕsīl*?
Dost thou bring out *mazzārōth* in his season,
or dost thou lead out *'ayish* with her young?'

We have already dealt with three of the terms which occur here. We have now to consider—

5. מַזָּרוֹת, *mazzārōth*. The Vulg. has 'Lucifer'; Targ. שמרי מוליא. The word may come from זָרָה, *zārāh*, which means literally 'to scatter,' but can be applied to powder (Ex 32[20]), hair (Ezk 5[2], Is 30[20]), etc. *Mazzārōth* would then mean 'scatterers' or 'sprinklers,' the reference being to rain. On this supposition, Stern and Hoffmann understand the Hyades to be meant, since the heliacal rising of their chief star, Aldebaran, announces the season of rain.[2] Gesenius derived the word from נזר, *nāzar* (Arab. نذر), and explained it as 'astra præmonentia.' Another suggestion is that it is derived from זהר, *zāhar*, *mazzārōth* being for *mazhārōth*, and meaning the 'brilliant' stars which shine with a special lustre, the planets, either all of them or the brightest and most striking. But the word is more commonly regarded as identical with *mazzālōth* (מזלות) in 2 K 23[5], the interchange of *l* and *r* presenting little difficulty. The LXX has μαζουρώθ in both cases. In 2 K *mazzālōth* has been supposed by some expositors to mean 'the signs of the zodiac,' being apparently a loan-word from Assyr. *manzaltu* or *mazaltu*, 'station, abode (of gods),' which, again, is from *nazâzu*, 'to stand.' But in the passage in question it would be more natural to find mention of the planets, and some expositors so interpret *mazzālōth* (in Rabbinic *mazzālōth* means 'planets' as well as 'signs of the zodiac'). *Mazzālōth* would be the stars and planets regarded as 'mansions' (Assyr.) of the great gods (see *EBi*, *s.v.* 'Mazzaloth').[3]

[1] Kittel would read כּוֹכָבֵיהֶם, 'their stars.' But this is not necessary. Nor is it necessary to follow Cheyne in emending the whole of the beginning of the verse thus: עָשׁ וְכִימָה וּכְסִיל, 'the Great Bear, the Pleiades (?), and Orion.'

[2] An old English name for them is 'the seven stars' (AV in Am 5[8]).

[3] The Hebrew has מַעֲנֻדוֹת כִּימָה, *ma'dannōth kīmāh*, which AV translates 'sweet influences,' some such idea being suggested by the root as found elsewhere. It is better, however, to follow many modern expositors, and regard *ma'dannōth* as equivalent to *ma'naddōth*, 'bands' or 'fetters,' from *'ānad*, 'to bind' (so Ewald, Dillmann, Duhm, and others). If we translate 'bands,' we may think of the Oriental poets' habit of comparing the Pleiades with an ornament (Ideler, *Sternnamen*, p. 147).

[4] According to Stern, the Talmudists undoubtedly understood the Hyades by *'ayish*. May there not be references to an earlier form of this kind of legend in Job 38[31f.]? The passage might be translated thus (interchanging תקשר and תפתח in ver. 31):

Dost thou loosen the bands of the Pleiades (*kīmāh*)
or bind fast the cords of a giant (-star, *kĕsīl*)?
Dost thou lead forth the rainers (*mazzārōth*) in due season
and comfort the Hyades for its children?

The 'rainers' (from זָרָה, lit. 'to scatter') would be the stars taken from the Hyades, and are referred to in the next clause as 'its children.'

[1] Cf. A. B. Davidson, 'Job' in *Cambr. Bible*, 1893: 'probably the great spaces and deep recesses of the southern hemisphere of the heavens, with the constellations which they contain.'

[2] Stern identifies *mazzārōth* with *mazzālōth*, and would derive the latter from חָזַל, *ḥizzēl*, 'to cause to flow.' This, again, would give some meaning equivalent to 'rain-producers.'

[3] P. Jensen (*JE*, *s.v.* 'Astronomy') says that *mazzālōth* may mean either 'planets,' 'signs of the zodiac,' or 'stations of the moon.'

It is not necessary, however, to regard *mazzārōth* and *mazzālōth* as identical. We have found reason to think that another word denotes the Hyades as a constellation. That does not prevent us from supposing that *mazzārōth* may be a further description of some of the stars in this group.[1] The word *mazzārōth* has also been identified with the Great Dog, whose chief star is Sirius. This, as the brightest of the fixed stars, and for meteorological reasons as well, everywhere attracted the notice of the ancients.

6. It should be noted further that in Job 37[9] another word occurs (מְזָרִים, *mĕzārīm*) which bears some resemblance to *mazzārōth*. The passage runs: 'Out of its chamber cometh the whirlwind, and cold out of *mezārīm*.' This word might also come from *zārāh*, 'to scatter.' On that assumption, it has been supposed to mean 'scattering' or north winds. Another suggestion, however, is that it is a corruption of the Babylonian *mišri*, 'the northern (star)' (so *EBi*, *s.v.* 'Mazzaroth'). A more recent conjecture is that of Schiaparelli (p. 69 ff.). He suggests that the correct punctuation of מורים is *mizrīm* or *mizrayim*, *i.e.* the plural or dual of a word מִזְרֶה, *mizreh*, which is referred to in Is 30[24] and Jer 15[7] as an instrument for winnowing. Schiaparelli points out that the arrangement of the stars of the Great Bear is such that they might be thought to resemble a winnowing fan. To the ancient Chinese these stars actually suggested a ladle, which, with its cavity and handle, is very like a winnowing fan. The plural *mizrīm* would indicate more than one instrument. Schiaparelli therefore thinks that the word might designate the Great Bear and the Lesser Bear; and in that case, of course, the dual *mizrayim* would be a still more suitable description. The fact that the Phœnicians used the Lesser Bear when at sea to find the direction of the north is noteworthy in this connexion. The suggestion is very ingenious. But unfortunately *mizreh* is not the term which denotes a winnowing instrument of the shape required. The word for that is *raḥath* (the other term mentioned in Is 30[24]). *Mizreh* is apparently the *midhrā* of modern Syria, a pitch-fork with six prongs, and the Great Bear can hardly be said to resemble that.

7. Some expositors have found yet another reference to astronomy in the נָחָשׁ בָּרִחַ, *nāḥāsh bārīaḥ*, of Job 26[13]. Meaning literally 'the fleeing serpent,' the words have been supposed to refer to the Dragon between the Great and the Little Bear. There is nothing in the context, however, to indicate that the author had any star or constellation in mind.

The OT contains very few definite references to astrology, though the prohibition in Dt 18[10] shows that it was practised. We can hardly say that there was no astrology amongst the ancient Hebrews, in spite of the fact that the present allusions are late and due to Assyro-Babylonian influence. In Is 47[13] (post-Exilic) we read: 'Yea let them deliver thee, the dividers (?) of heaven (הֹבְרֵי שָׁמַיִם), the gazers on stars (הַחֹזִים בַּכּוֹכָבִים), those who make known each new moon (מוֹדִיעִים לֶחֳדָשִׁים), from the things that are coming upon thee.' The word translated 'dividers' occurs here only, and LXX has for the whole phrase *οἱ ἀστρολόγοι τοῦ οὐρανοῦ*. It has been connected with an Arabic word 'to divide' (*habara*, lit. 'to cut into large pieces'), a meaning which suits very well, since the Babylonians divided the sky for astrological purpose into signs of the zodiac. 'Those who make known each new moon' (or the 'monthly prognosticators') would be persons, like the Assyrian and Babylonian astrologers, who noted lucky and unlucky days, preparing monthly almanacs or calendars based on astrological calculations (see Cheyne, 'Isaiah,' *PB*, 1898). In Dn 5[11], according to AV, Daniel became chief of the 'astrologers' (אַשָּׁפִין) in Babylon; but the correct translation of the word is 'conjurers' or 'enchanters.'

[1] See the conjecture made above on p. 82[a], note 4.

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SUN, MOON, AND STARS (Hindu).—1. **The sun.**—Solar worship has been described as the real religion of India. Nor is it difficult to understand how in a land flooded with sunshine, where every phase and function of life is dependent upon the kindly warmth of the sun and his destructive energy and power are felt in the uttermost extremes of heat, it should have been man's primary business to win his favour and placate his wrath. In the ancient verse of the *Gāyatrī* every Hindu begins his day with prayer and ascription of praise to the sun, the giver of light, heat, and fertility. In his mid-day devotion also he remembers and renders homage to the same deity. It is apparently true that at no period in India was the worship of the sun to any great extent exclusive. There are no distinct sects at the present time who reverence the sun alone and bear his name. The essentials of his worship, however, are present everywhere and in all the sects, more or less avowedly, or in disguise, and combined with other cults; and his practical and decisive influence on daily life is universally recognized.

In the *Rigveda* Sūrya, or the sun, is worshipped under many names and forms. The three chief aspects under which he presents himself to his worshipper are the rising, culminating, and setting sun. These are not separated or distinguished as three deities, but are varying forms of one and the same god, in each of which he displays himself with different attributes and as exercising different powers. Especially is he reverenced as Savitṛ, the giver and sustainer of life, who each morning wakes the universe and men from sleep. One of his most ancient cults, perhaps the most ancient of all, is under the name Mitra, the Persian Mithras; whence some have conjectured that India derived her solar religion from the West. If borrowing took place on either side, it is probable that in those early days the indebtedness was Persian. As Mitra, the sun was associated as a member with an early triad, symbolized by the sacred syllable *Om*, Agni or fire, Vāyu the wind, and Mitra. This triune aspect also was manifested in the sun as the heavenly fire, and he bore corresponding epithets or titles, as *tripād*, 'three-footed,' *trivikrama*, 'three-stepping,' and others. The last name was appropriated more particularly to Viṣnu, the sun as the all-pervader, who in three strides traverses the three worlds, earth, heaven, and hell. He is invoked also as Pūṣan, the guardian and preserver of the cattle, the companion of travellers, and guide of the soul on its perilous way to the lower world.

In the mythology Sūrya is the son of Dyaus, the wide-spreading sky, and is described as 'all-creating' and 'all-seeing.' In this aspect his most ancient and significant name is Prajāpati, the 'lord of creation.' He traverses the heavens in his golden car, drawn by seven steeds, of which Uṣas, or the Dawn, is the charioteer; and the Aśvins, twin gods of the morning, are his children. By his power he drives away the demons of sickness,

and expels diseases and all the subtle and dreaded influences of darkness. The beneficent offices of physician and healer of bodily ills, which later are ascribed to the Aśvins, are in the first instance those of Sūrya himself.

There seems no reason to reject or doubt the statement of Śaṅkara in the 10th cent. that in his time there existed distinct sects of sun-worshippers, Sauryas, of one at least of which the members were accustomed to carry branded on their forehead and breast the symbol of their deity. They have, however, all died out and been forgotten.[1]

Not many temples dedicated to the worship of the sun have survived, nor is it probable that at any period in Indian history they existed in any considerable number. That at Konārak in Orissa is the best known, and architecturally of the most interest. It is, however, neglected and ruinous, and attracts no worshippers. There is another at Gayā, and a small but much-frequented shrine at Benares, where the fire-sacrifice is offered in honour of the sun.

Among the non-Aryan peoples of India and the sub-tribes, who may be described as on the borders of Hinduism, sun-worship is much more open and confessed. By the Dravidians and Kolarians the sun is widely invoked as Parameśvar, the creator and preserver, and is worshipped with prayer and sacrifice. The most popular form of offering is a white cock, whose head is struck off at the village shrine. He is Sūrāj Nārāyan (Sūrya-Nārāyaṇa), and the traders in the bazaars draw images or symbols of the sun at the entrance to their booths for good luck.[2] Similar representations or figures may be often seen on pillars. The *nīm*-tree is especially sacred to the sun, and there exists a popular legend or story which records its association with his cult. By many the *Holī* festival in the south of India is believed to have been instituted originally in order to propitiate the sun-god. He is invoked also to avert or to heal disease, and on the occasion of an eclipse the tom-toms are beaten and other ceremonies observed to rescue the deity from the powers of evil. The same conception, that worship and sacrifice are efficacious to avert disaster from the object of worship, may perhaps be recognized in the especial frequency of sun-ritual and adoration in the winter season among some northern tribes, at a time when the divinity may be supposed to be weak. A sacred meal is partaken of in his honour, and this must be eaten without salt. A similar ritual is observed when the sun enters a new sign of the zodiac. There are races and peoples in India at the present time who believe themselves to be descended from the sun.

2. The moon.—From the earliest times in India it would appear that the moon has been a popular subject of traditional story and mythology, but, so far as is known, there never existed any formal moon-cult or sectarian worship. A late work of the 17th cent. mentions 'moon-worshippers' and 'star-worshippers.' It is improbable, however, that any special sect was in the writer's mind. Worship of the moon in one or other of her aspects, either alone or in conjunction with other rites, is common in India at the present day, and such worship has in all probability never been intermitted. There are, however, no exclusive votaries or sects who make the moon their chief deity. In this respect, therefore, the popular worship of India is in contrast with the established cults of ancient Babylonia and other countries.

In the *Rigveda* and the early literature Soma (*q.v.*) is identified with the moon, and in one passage at least the waning of the moon is caused by the gods drinking up the nectar (*amṛta*).[3] The great deities Indra and Agni are identified with its phases, representing the new and full moon respectively; so also Varuṇa and Mitra are deities of the waxing and waning moon.[1] As usual among primitive peoples, the moon is a male divinity. A title of Śiva is *chandra-śekhara*, 'he whose crest is the moon,' *i.e.* the moon-bearer, and in this sense he is contrasted with Viṣṇu, who represents the sun. The ancient lunar dynasty of India (*chandravaṁśa*), whose capital was at Hastināpura, or Delhi, about 50 miles north-east of the modern city, claimed descent from the moon.

The moon also (Soma) was one of the treasures recovered at the churning of the ocean, together with the *amṛta* (nectar). Elsewhere he is enumerated among the eight *lokapālas*, or guardians of the universe. He is lord of the planets and of plants, of offerings and of penances.[2] More often he is regarded as one of the nine planets and is associated with them in worship, but especially with the sun. The departed go to the moon, and there is the abode of the *pitṛs*, 'fathers,' whither they are borne on the smoke of the funeral pyre. A more popular title or a more popular ritual for him is as Oṣadhipati, or Oṣadhīśa, 'lord of plants.' Agriculture in general is under his protection and is subject to his influence.

The phases of the moon are often decisive for the work of the fields; and the economy of the household, with its various anniversaries and important events, is similarly determined by the moon's position and aspects. The title 'lord of plants' is probably derived from the practice, common also in other countries, of collecting medicinal herbs, etc., by the light of the moon. In this character he is a god of healing, and for certain diseases—*e.g.*, leprosy—to gaze at the reflexion of the moon in *ghī* or oil is an important and efficacious remedy. The periods of new and full moon are especially dangerous owing to the increased activity of the spirits at these times. In some parts of the country the conch-shell is a symbol of the deity of the moon. Among some of the primitive Kolarian tribes, instead of being regarded as a male divinity, the moon is mythologically the wife of the sun, and the stars are their children.

3. The stars.—The principal stars and constellations are known to the Hindus by name, and are recognized as beneficent or the reverse, especially in their relation to family and individual happiness or misfortune.

Thus the Pole-star is *dhruva*, 'fixed' or 'stationary,' although the same title is given to some of the *nakṣatras* (see below). The seven stars of the Great Bear are seven *ṛṣis*, translated to the heavens. Canopus also is a *ṛṣi*, Agastya, the sage and reputed evangelist of S. India. The Pleiades are the six *kṛttikās*, 'nymphs,' the nurses of Skanda, the god of war, who bore from them the title of Kārttikeya. Orion represents the head of Brahmā in the form of an antelope's or stag's head (*mṛgaśiras*), struck off by Śiva, etc. Great regard is paid especially to the planets and the constellations or groupings of stars known as *nakṣatras*; and the star, planet, or constellation under which a man is born gives infallible indication of his future lot. In parts of N. India the stars generally are the cattle that the moon tends in the character of shepherd.

The full number of the planets is nine, but sometimes only seven or five are enumerated. There is a temple at Benares dedicated to the nine planets, where flowers and other offerings are presented. The complete number includes the sun and moon, and the others in order are Mercury, Venus, Mars, Jupiter, Saturn, with Rāhu and Ketu. The two last represent the ascending and descending nodes of the moon's orbit.

Rāhu is the cause of eclipses, when he swallows the sun or moon, and this he is said to do in revenge for the loss of his head, which was cut off by Viṣṇu as a punishment for his having stolen and drunk part of the nectar churned from the ocean. By drinking the *amṛta* he became immortal, and his wrath is perpetually exhibited in the eclipses, when the village folk seek to propitiate him with various rites. Rāhu is therefore known as the bodiless, and there exists at Benares a shrine dedicated to him under this form. Ketu is the progenitor of the numerous tribe of meteors and comets. In the *Purāṇas* they are all described as deities, each with his own car, that of Mars being golden with eight red horses. The days of the week also are named from them.

Some of the planets are favourable and some malevolent; but all need to be propitiated and their favour if possible secured before a marriage or other important event in the household. The omission of the *śānti* or *śānti-karman*, the 'propitiation' ceremony, would most certainly result in harm and disaster.

[1] See art. SAURAPĀTAS, SAURAS, or SAURYAS.
[2] See art. SYMBOLISM (Hindu).
[3] *Rigveda*, x. lxxxv. 5.

[1] *Śatapatha Brāhmaṇa*, II. iv. 4. 17 f.
[2] *Vishṇu Purāṇa*, i. 22.

Rāhu and Ketu, with Saturn, are deities of ill omen who presage sickness and all kinds of trouble, and to be born when one of these is in the ascendant is a grave misfortune. The remaining planets are propitious, especially Mercury, Venus, and Jupiter, in whose hands are the gifts of wisdom and all knowledge and skill.

In the *Rigveda nakṣatra* is the name for a constellation in general. Universally, however, in later times and technically the *nakṣatras* are the lunar mansions, or stations, through which the moon passes, as the sun through the twelve signs of the zodiac. Originally these seem to have been 27 in number, but in the later literature and in astrological calculations more usually 28. Mythologically they are the wives of the moon and daughters of Dakśa, one of the Ādityas. Like the planets, the *nakṣatras* are important and influential deities, whose countenance is sought before undertaking a journey or making arrangements for marriage or other domestic rites. Every Hindu boy's horoscope contains a reference to the *nakṣatra* under which he is born, and he bears a secret name other than that which is given him at the special name-giving ceremony (*nāmadheya*), which is written in the horoscope and is stated to contain always one letter at least from the name of the *nakṣatra* through which the moon was passing at the hour of his birth.

LITERATURE. — M. Monier-Williams, *Brāhmanism and Hindūism*[4], London, 1891, pp. 341–346; W. Crooke, *The Popular Religion and Folk-Lore of Northern India*, 2 vols., do. 1896, *passim*; A. S. Geden, *Studies in the Religions of the East*, do. 1913, pp. 212 ff., 221 ff.; S. Reinach, *Cults, Myths, and Religions*, tr. E. Frost, do. 1912; H. Whitehead, *The Village Gods of South India*, Oxford, 1916; W. J. Wilkins, *Modern Hinduism*, London, 1887, *Hindu Mythology, Vedic and Puranic*, Calcutta, 1882.

A. S. GEDEN.

SUN, MOON, AND STARS (Iranian).—Astronomy received much attention in ancient Persia, as is obviously implied by the current tradition that the Magi, the sacerdotal class of the Medes and Persians, were highly skilled in divination, an art which depended largely upon a knowledge of the heavenly bodies, astrology and astronomy being sister sciences in antiquity. The part which the veneration of the sun, moon, and stars played in the national religion of early Iran is well known (see art. ZOROASTRIANISM), and some of the Greeks regarded Zoroaster as much in the light of a professed astrologer and star-worshipper as in that of a wise man and prophet (cf. Diogenes Laertius, *Procem.* i. 6, *ἀστροθύτην*; Scholiast on the Platonic *Alcibiades*, i. 122; *Clementine Homilies*, ix. 3–6, *Recognitiones*, iv. 27–29; Suidas, *Lexicon*, *s.v.* *ἀστρονομία*, *Ζωροάστρης*—all collected in Jackson, *Zoroaster, the Prophet of Ancient Iran*, New York, 1899, pp. 226–273). The Avesta and the Pahlavi books, especially the *Bundahišn* and *Dīnā-i Maīnōg-i Khraṭ*, contain frequent allusions of an astronomical nature; and Persian literature, after the Muhammadan conquest of Iran in the 7th cent., contains similar references. These three sets of sources furnish our chief supply of information, supplemented by comparisons drawn from Babylonia and Assyria, as well as by other material.

1. Conception of the universe.—The ancient Iranians naturally based their astronomical system upon a geocentric conception of the universe. It is probable that in the earliest times the shape of the earth was regarded as round and flat, although it is not altogether clear whether the Avestan word *skarəna*, 'round' (cognate with the Greek *σφαῖρα*), signified merely circular, or whether it actually meant spherical (*Yašt*, v. 38, x. 95, xvii. 19). It is almost certain, however, that in later times the globular form of the earth was recognized by the Persian astronomers, possibly influenced by Ptolemy, who was a great authority among the Arab-Persian scientists. The spherical shape may be inferred from two Pahlavi passages which apparently contain the idea of the cosmic egg—a wide-spread notion in antiquity. The first of these passages occurs in the *Dīnā-i Maīnōg-i Khraṭ*, xliv. 1–11 (tr. West in *SBE* xxiv. 85): 'The sky is arranged above the earth, like an egg, by the handiwork of the creator Aūharmazd; and the semblance of the earth, in the midst of the sky, is just like as it were the yolk amid the egg.' The second Pahlavi passage is found in the *Dīnkarṭ*, ii. 74. 2 (ed. Peshotan Sanjana, Bombay, 1876, ii. 72): 'The world and the other creatures are placed together in the midst of the sky, like the bird in the midst of the egg; the sky surrounds all, as the egg does the bird' (tr. Casartelli, *Mazdayasnian Philosophy*, Bombay, 1889, p. 107). In the arrangement of the universe the earth was regarded as encompassed by the atmosphere (Av. *vayu*, Phl. *vāi*; or Av. *θwāša*, Phl. *spihr*), above which was the sky or firmament (Av. O.P. *asman*, Phl. *Asmān*, lit. 'stone'), beyond which again rose the empyrean realm (Av. *anaγra raŋčā*, lit. 'endless lights'), the abode of Ormazd and his angels. Through a misapprehension of the true facts, moreover, the sun and moon were located beyond the sphere of the stars (cf. Phl. *Arṭā-Vīrāf*, vii. 1–x. 13; *Bundahišn*, iv. 4; *Zāṭ-Sparam*, vii. 6; *Šāyast lā-Šāyast*, xii. 5; *Gr. Iran. Bund.*, tr. Darmesteter, *Le Zend-Avesta*, ii. 310; *Dāṭistān*, ii. 1, xxxiv. 2; Av. *Vendidād*, vii. 52; and consult Jackson, 'Die iranische Religion,' § 66, in Geiger and Kuhn, *Grundriss der iranischen Philologie*, ii. 671–672).

2. Sun and moon.—In the Zoroastrian ritual, as preserved in the Avesta, both the sun (*hvar*) and the moon (*māh*) receive high veneration individually, and each has a special hymn of praise devoted to its glorification (*Yašt*, vi. and vii.); besides, minor litanies and prayers are consecrated to their particular service (*Sīrōzah*, i. 11, ii. 11; *Yašt*, vi. 1–7, vii. 1–7; *Nyāiš*, i. 1–10, iii. 1–11). A similar degree of reverence was accorded them during Parthian and Sasanian times, as is shown by the Pahlavi texts themselves and by allusions in the Greek and Latin classics (*e.g.*, Phl. *Šāyast lā-Šāyast*, vii. 1–3; *Dīnkarṭ*, i. 51. 6, the former translated by West in *SBE* v. 297–298, and the latter by Peshotan Sanjana, Bombay, 1875, i. 47, and tr. p. 48: cf. also such classical writers as Strabo, xv. 3. 13, p. 732; Ammianus Marcellinus, *Hist.* xxiii. 6, xvii. 5; Dio Chrysostomus, *Orat. Borysthenitica*, xxxvi.; and Nicolaus Damascenus, frag. 66, p. 401, ed. Müller). The supremacy of the sun among the heavenly bodies is naturally emphasized in the Avesta (*e.g.*, *Yašt*, vi.), and its various positions in the heavens are described in *Bundahišn*, v. 1–7, and *Šāyast lā-Šāyast*, xxi. 1–7. In the latter passage there are to be found special observations of the midday and afternoon shadows with respect to the sun's altitude in the various zodiacal constellations. Solar observations were important in determining the various times of day for performing the sacrifice.

The moon, like the sun, is invoked because of its beneficent influence (*Yašt*, vii. 1–7), and there are several specific allusions to its periodic phases (*e.g.*, *Yasna*, xliv. 3; *Yašt*, vii. 2–4; *Fragment*, viii. 1; *Dāṭistān-i Dīnīk*, lxviii. 1–6, lxxi. 2, tr. West, *SBE* xviii. 210–211, 215). The connexion between the moon and the tides was fully recognized in Sasanian times, and a crude attempt was made to explain it (see *Bundahišn*, xiii. 13–14; *Zāṭ-Sparam*, vi. 14–17). Eclipses, both of the sun and of the moon, were regularly taken into account 'in the calculations of the astronomers,' at least under the Sasanians, as is shown by *Dāṭistān-i*

Dīnīk, lxix. 1–7, and the cause of these obscurations was thought to be the intervention of two bodies that revolve below the two greater lights (*Dāt.* lxix. 1–7; *Šikand Gūmānīg Vijār*, iv. 46, tr. West, *SBE* xviii. 212–213, xxiv. 132).

3. Stars.—There is an abundance of star-lore throughout the entire literature, and particular stars, or groups of stars, are alluded to as guarding the quarters of the heavens into which the Zoroastrians divided the firmament. The chief star in the Avesta, as elsewhere, is called Tishtrya (Av. *tištrya*, Phl. *tištr*), and it is usually identified with Sirius. Tishtrya is regent of the eastern division of the sky, an opponent of the meteors, and the bringer of rain by overcoming Apaosha, the demon of drought (*Yašt*, viii. 1 ff.; *Bundahišn*, ii. 7, v. 1, vii. 1, ix. 2). The fixed star Satavaēsa (Av. *satavaēsa*, Phl. *sat-vēs*, 'having a hundred servitors'), which is possibly to be identified with Fomalhaut, is an ally of Tishtrya, and lord of the southern heavens (*Yašt*, viii. 9, 32, 43, 44; *Bundahišn*, ii. 7, v. 1, xiii. 12; *Šāyast lā-Šāyast*, xiv. 5, vi. 16). The guardianship of the west is entrusted to Vanant (Av. *vanant*, Phl. *vanand*, 'victorious'; cf. *Yašt*, xxi. 1, viii. 12, xii. 16; *Nyāiš*, i. 8; *Bundahišn*, ii. 7, v. 1; *Mainōg-i Khrat*, xlix. 12; *Šikand Gūmānīg Vijār*, iv. 28–38), while the keeping of the north is consigned to the constellation of Ursa Major, called Haptō-iringa (Av. *haptō-iringa*, Phl. *haptō-iring*, 'with seven signs'; cf. *Yašt*, viii. 12, xii. 28, xiii. 60; *Bundahišn*, ii. 7, v. 1, xiii. 12; *Mainōg-i Khrat*, xlix. 12; *Šikand Gūmānīg Vijār*, iv. 28–38). The Pleiades (Av. *paoiryaēinī*) are mentioned in the Avesta (*Yašt*, viii. 12), and there are certain other allusions that may contain the names of special stars, though their interpretation is open to question (see Kuka, 'Stars mentioned in the Avesta' in *Zartoshti*, ii. 7–22, Bombay, 1904). In giving an account of creation, the Pahlavi book *Bundahišn* (ii. 5) sets the number of stars at 6480 (or 6,480,000, according to another reading). This figure is not uninteresting when taken in connexion with the fact that astronomers generally allow that between 5000 and 8000 fixed stars are visible to the naked eye. Regarding the identification of certain of the major stars, though some are positively sure, reference may be made to a monograph by Muncherji P. Kharegert, 'Some Heavenly Bodies mentioned in Old Iranian Writings,' in the *Sir Jamsetjee Jejeebhoy Madressa Jubilee Volume*, Bombay, 1914, pp. 116–158; see also Moulton, *Early Zoroastrianism*, London, 1913, pp. 23–27, 210–213, 279–281.

4. Planets, meteors, and comets.—In contrast to the fixed stars and regular constellations, the planets, meteors, and comets were held by Zoroastrians to be disturbers of the established order of the universe, and consequently to be of Ahrimanian origin and evil nature—a point of view directly opposed to that of Babylonia, where the planets were looked upon as distinctly beneficent in character (cf. Jastrow, *Religion of Babylonia and Assyria*, Boston, 1898, p. 373). To the planets Mercury, Mars, Jupiter, Venus, and Saturn (the only five then known, but making seven with the sun and the moon, by the side of which they were usually mentioned) there were given, respectively, in Pahlavi the euphemistic names *Tīr*, *Vahrām*, *Aūharmazd*, *Anāhid*, and *Kēvān*, derived from divine names, including the name of the god Ahura Mazda himself, because these beneficent powers curb and restrain the maleficent influence exercised by the planets (*Bundahišn*, v. 1–2; *Šikand Gūmānīg Vijār*, iv. 1–5; *Zāt-Sparam*, ii. 10, iv. 7–10, vi. 1–2; and consult the list in al-Bīrūnī, *Chronology*, tr. Sachau, London, 1879, p. 172). The Persian treatise *Ulamā-i Islām* (tr. Vullers, *Fragmente über die Religion des Zoroaster*, Bonn, 1831, p. 52) states that they originally bore the names of demons, but were afterwards given designations of good omen. At the same time it is not impossible that we have in their nomenclature a translation of the Babylonian names of the planets, *Nabu*, *Nergal*, *Marduk*, *Ištar*, *Ninib*, as may be surmised from the equations, Marduk (lord of the gods) = Aūharmazd = Jupiter; Nergal (god of war) = Vahrām = Mars; and Ištar = Anāhid = Venus; on the confusion between Tishtrya ('Sirius') and Tīr ('Mercury') compare the note by Gray, *ERE* i. 798[b]; and, for the Babylonian names of the planets, consult Jensen, *Kosmologie der Babylonier*, Strassburg, 1890, pp. 134–139; Jastrow, *Religion of Babylonia and Assyria*, pp. 370, 454–466. This parallel, in any case, is of interest because the Sanskrit names given by the Hindus to the planets show no likeness to the Babylonian (cf. Weber, *Vorlesungen über indische Literaturgeschichte*[2], Berlin, 1876, p. 267 f.). Shooting stars are alluded to in the Avesta (*Yašt*, viii. 8) under the name of *kərəmā stārō*, a designation meaning, perhaps, 'worm stars'; and there are several passages, in both Avesta and Pahlavi literature, which allude presumably to comets (*Yasna*, xvi. 8; *Bundahišn*, v. 2, xxviii. 44, xxx. 17; *Dātistān-i Dīnīk*, xxxvii. 55, lxix. 2).[1]

5. Signs of the zodiac.—The names of the twelve signs of the zodiac, at least in Sasanian times, correspond in concept with those familiar to us through the Greek and Latin designations, and are parallel likewise with the Babylonian, from which, like the Indo-Germanic zodiac in general, they are believed to be derived, and of which their names are translations—a phenomenon precisely paralleled in India and in other Asiatic countries (see Ginzel, *Handbuch der Chronologie*, i., Leipzig, 1906, pp. 78–88). Thus in Pahlavi we find *Varak* ('Ram,' Aries), *Tōrā* ('Bull,' Taurus), *Dō-patkar* ('Two-figures,' Gemini), *Kalakang* ('Crab,' Cancer), *Sēr* ('Lion,' Leo), *Khušak* ('Maiden,' Virgo), *Tarāzuk* ('Balance,' Libra), *Gazdūm* ('Scorpion,' Scorpio), *Nēmasp* ('Half horse,' Centaur or Sagittarius), *Vahīk* ('Goat,' Capricorn), *Dūl* ('Waterpot,' Aquarius), *Mahīk* ('Fish,' Pisces). The names of the twenty-eight lunar mansions, as recognized in 'the subdivisions of the astronomers' (Phl. *xūrtak-i hāmārīkān*), are given in the *Bundahišn* (ii. 3); but the reading of the various designations is by no means sure, and the individual identification of the names remains, therefore, uncertain, even when compared with those in the Soghdian and Khorasmian list, given about A.D. 1000 by al-Bīrūnī (*Chronology*, tr. Sachau, p. 227 f.).[2] Possibly some further light may be gained from a study of the terminology used for these asterisms by the Hindus, Chinese, and Arabs, if not by the Babylonians (see Ginzel, *op. cit.* pp. 70–76). Such an attempt has already been made from the Sanskrit side, in comparison with Avestan and Pahlavi, by a Parsi scholar named Anklesaria, in an article entitled 'Asterisms in Iranian Literature' in *Cama Memorial Volume*, Bombay, 1900, pp. 216–227.

6. Prediction of events.—Like the reference in the preceding paragraph to the minute subdivisions used by the astronomers (*Bund.* ii. 3), there are kindred allusions in Sasanian literature to 'the calculations of the astronomers' or to 'the com-

[1] The Soghdian names of the planets given by Manichæan fragments discovered at Turfan, in Chinese Turkestan, correspond in general to the forms given above (see F. W. K. Müller, 'Die "persischen" Kalenderausdrücke in chinesischen Tripiṭaka,' *SBA W*, 1907, pp. 458–465).

[2] The zodiacal names given by the Turfan fragments (Müller, *loc. cit.*) are identical with those of Eastern Asia, as found in China, Siam, and Cambodia, as well as in Tibet and in Old Turkish inscriptions (Ginzel, pp. 85–87, 404, 411, 452, 501), thus differing entirely from the Babylonian nomenclature.

putations made by astrologers' with regard to observing favourable or unfavourable conjunctions of the stars (*e.g.*, *Dāṭistān-i Dīnīk*, lxix. 3; *Śikand Gūmānīg Vijār*, iv. 28; *Epistles of Mānuščihar*, II. ii. 9–11; see West, *SBE* v. 11, xxiv. 130, xviii. 212, 333–335, xxxvii. p. xlvii). Ardavān, the last of the Parthians and predecessor of Ardashīr Pāpakān, who founded the Sasanian dynasty in the 3rd cent. A.D., is represented as consulting on grave matters with his 'wise men and constellation-knowers' (*dānakān va axtar-mārān*, in the Pahlavi text *Kārnāmē-i Artakhshīr-i Pāpakān*, ii. 4–5, iii. 5–6, ed. Darab Peshotan Sanjana, Bombay, 1896, pp. 10–11, 15–16), and their knowledge of the position of the stars at the moment enabled them to predict to him future events. In a Pahlavi work dated A.D. 881 and entitled *Epistles of Mānuščihar*, II. ii. 9–11 (re-translated by West, *SBE* xxxvii., Introd. p. xlvii), there is a specific allusion to a set of astronomical 'tables' (Phl. *zīk*, cf. Arab. *zīj*, and the Byzantine Gr. ζῆζι of Theodorus Meliteniotes, ed. Usener, *Ad historiam Astronomiæ Symbola*, Bonn, 1876, p. 14), which were constructed by 'the great Shatro-ayār.' See, more fully, art. SUN, MOON, AND STARS (Muhammadan), p. 95[b] below. The passage cited mentions the tables alongside of those of Ptolemy and of the Hindus.

7. Astronomical works.—Some of the works from which citations have been drawn above, like the one last quoted, actually belong to the early Muhammadan period of Persia, even though written in Pahlavi. Astronomy, influenced by Arab science, continued to flourish in Iran under Muslim rule. The notable scientific achievements of the great savant and chronologist, al-Bīrūnī of Khiva (973–1048), are sufficient to prove that fact, and it is certain that computations of the positions of the heavenly bodies must have played an important part in the reform of the calendar and establishment of the new Jalalian era, in 1079, by the Seljūk sultan, Jalāl-al-dīn Malikshāh, under the direction of a commission of scholars headed by the well-known astronomer poet, Omar Khayyam. Omar, in fact, had been summoned to Merv by the sultan, four years previously, to make observations in the royal observatory, and there he constructed the *Zīj-i Malikśāhī*, 'Astronomical Tables of Malikshāh,' which were employed in the calendar reform. The names of two of his colleagues engaged upon the reform were Abu'l Muẓaffar al-Iṣfizārī and Maimūn ibn Najīb al-Wāsiṭī (see Browne, *Literary History of Persia*, London, 1906, ii. 181, n. 2). A section of a large work composed in 1082–1083 by Kai-Kā'ūs and entitled *Qābūs-Nāmah* (ch. 34) was devoted to 'astrology and mathematics' (ed. Teheran, 1285 A.H.; tr. A. Querry, Paris, 1887; cf. Browne, *Lit. Hist. Pers.* ii. 277). The Persian poet Anvarī, of the 12th cent., was a great astrologer, and a conjunction of the planets in the sign of Libra, calculated to take place on September 16, 1186 (or in October of the preceding year, according to other accounts), led him to predict dire calamities for that day; but happily they did not occur (see Browne, *Lit. Hist. Pers.* ii. 368; Horn in *GIrP* ii. 262–263). In the 13th cent. the Mongol ruler Hulāgū Khān, grandson of Chingīz Khān, established a celebrated observatory at Marāghah, in Azarbaijan, Western Persia, the building of which was begun in 1259, and traces of its ruins are still to be seen (cf. Wilson, *Persian Life and Customs*, New York, 1895, p. 77). Hulāgū's astronomer-royal was the learned Naṣīr-al-Dīn of Ṭūs (1201–1274), whose *Zīj-i Īlkhānī*, or almanac and astronomical tables, was a notable contribution to science (see Browne, *Lit. Hist. Pers.* ii. 484–486). The names of several other mediæval Persian astronomers, with a mention of their tables, are found in the Byzantine treatise of Theodorus Meliteniotes, referred to above (ed. Usener, pp. 13–14). Best known among the astronomical tables, however, are those of Ulugh Begh, grandson of Timur and founder of the observatory at Samarkand, in which city he died in 1449. These tables, written in Arabic, were translated into Persian and were made accessible in Europe through a Latin version by Greaves (Gravius, London, 1652), and again by Hyde in Persian and Latin (Oxford, 1665), and more recently by Baily (London, 1843) in *Memoirs of the Royal Astronomical Society*, xiii. 79–125. With reference to the present status of astronomical studies in Persia itself, one of the largest meteorites in the world is preserved as a curiosity in the Shah's palace at Teheran to-day; but there is no astronomer-royal to know its true value, and Persia must still wait a renaissance before independent work in studying the heavens is done by those of native birth.

8. Influence of the heavenly bodies.—The astrological aspects of Persia's early studies of star-lore have already been indicated above. In fact, there is little reason to doubt that 'judicial astrology,' or the attempt to determine scientifically the presumed influence of the heavenly bodies upon the destiny of human events, was often regarded more highly than natural astrology, or astronomy in our sense, which confines its investigations to determining the motions and positions of the stars, sun, and moon, in order to gain more strictly scientific results, as we regard them.

In some of the paragraphs given above there have been allusions to the beneficent part played by the sun and the moon in the development of the world and in advancing the welfare of mankind (*e.g.*, *Yašt*, vi. 1–5, vi. 5; *Bundahišn*, vii. 2–4, and elsewhere), while the stars also entered into the sphere of human activity by exercising a kindly sway over the earth. Thus the great rain star Tishtrya, aided by Satavaēsa in the Avesta (*Yašt*, viii. 1–62; *Sīrōzah*, i. 13, ii. 13), combats the demon of drought, when invoked by men, and confers blessings upon his faithful worshippers. The victorious star Vanant (*Yašt*, xx. 1) repulses the influence of evil; and Haptō-iringa (Ursa Major) is effective even in tempering the torment of the souls in hell, a region located in the North (*Mainōg-i Khraṭ*, xlix. 15–21; *Śikand Gūmānīg Vijār*, iv. 31–33). The three fixed stars or constellations just named are regarded in the Pahlavi book *Śāyast lā-Śāyast* (xiv. 5–6), which was written about the 7th cent., but contains older material, as exercising an influence upon the efficiency of the sacrifice during the time of their ascendancy. In another chapter of the same work (*Śāyast lā-Śāyast*, xxi. 1–7) a specifically fortunate character is ascribed to the shadow of the noonday and afternoon sun when occupying certain positions in the zodiacal signs; and in *Dāṭistān-i Dīnīk*, vi. 9, the stars are synonymous with destiny. The malign influence ascribed to the planets has been sufficiently indicated above, and need not be referred to again in this section.

Sufficient reference has likewise been made to the part played by astrology, astrologers, and horoscopes both in Sasanian and in Muhammadan-Persian times. We need only recall the allusion to the last of the Parthian kings, Ardavān, and his astrologers (*Kārnāmē*, ii. 4–5, iii. 5–6), and we have the authority of the great Khorasmian scientist al-Bīrūnī for the fact that the Persian astrologers, like others, held that the zodiacal sign of Cancer was 'the horoscope of the world' (al-Bīrūnī, *Chronology*, tr. Sachau, p. 55). A good illustration, in the 17th cent., of ephemerid tables that were used also for horoscopic purposes may be found in a work translated from the Arabic, Persian, and Turkish, with a Latin commentary,

by Beck, in his *Ephemerides Persarum per totum annum*, Augsburg, 1696 (especially chs. iii.–iv., vi.). Even to-day the astrologer's art in casting a horoscope holds an important place in the life of the ignorant and superstitious folk of Persia, and it still survives, though it is gradually disappearing, among the Zoroastrian Parsis of India (cf. Karaka, *History of the Parsis*, London, 1884, i. 160–162).

LITERATURE.—For a translation of the Avesta and the Pahlavi books consult the versions by Darmesteter and West in *SBE*, vols. iv., xxiii.; and v., xviii., xxiv., xxxvii., and by Mills, *ib.* xxxi.; likewise the French translation by Darmesteter, *Le Zend-Avesta*, 3 vols., Paris, 1892–1893. The more important single works on the subject have been given in the course of the article.

A. V. WILLIAMS JACKSON.

SUN, MOON, AND STARS (Japanese).—In the ancient mythology of Japan the sun-goddess plays the most important rôle, while the moon-god, her brother, occupies an insignificant place, and almost nothing is told about stars. The commonly accepted story is that the sun-goddess (Amaterasu, 'the heaven-shining deity') and the moon-god (Tsuki-yomi, 'the ruler of the moonlight night') were born, together with the storm-god (Susa-no-wo, 'the swift-impetuous'), of the couple who were the progenitors of the Japanese archipelago.[1] In this story the creation of these deities is conceived evidently as a generative act, whereas another version makes the emergence of the two deities from the 'white copper' mirrors the work of the male progenitor alone. Perhaps a more interesting version of the story is that the sun and the moon were produced out of the eyes of the progenitor, when he was washing in order to purify himself from the stains with which he had been contaminated on his visit to the infernal world after the death of his consort.[2] Though there are these different versions, the common trait and predominant factor in the story is that the sun-goddess is considered to be the supreme ruler of heaven and earth, and also the progenitrix of the ruling family, who claim to have handed down from the goddess herself the three insignia of the throne (see below). Now the relation between the sun-goddess and the moon-god is based on the natural phenomenon that the two are visible alternately by day and by night. The story is as follows:

> The sun-goddess once commissioned her brother, the moon, to go down from their heavenly abode to earth to see Ukemochi, the female genius of food. When the latter entertained the moon with the food-stuffs taken out of her body, the moon became flushed with anger and slew the goddess of food. The sun-goddess was so displeased with her brother's wantonness that she said to him: 'Thou art a wicked deity. I must not see thee face to face.' Hence the sister and brother appear alternately in heaven.[3]

The intention of the story is evident, but at the same time it shows a characteristic of the sun-goddess as the matron of agriculture, which played a great part in the myths and worship of the goddess.[4] Thus, in contrast to the prominent rôle played by the sun-goddess, the moon plays a very inferior part, and a much smaller part is played by the stars. A star-god is mentioned in the ancient myth, but his rôle is quite ambiguous, while a festival in honour of certain stars (the stellar constellations called the Herdsman and the Weave-maid) was derived from China. All other stories and worship of stars are much later and were introduced chiefly through Buddhist agency, though some of them may have been derived from other sources—Hindu, Persian, or Chinese. The most prominent star-worship is that of the Pole star, together with Ursus Major. These stars, conceived as one deity, are worshipped by the Buddhists as the protector of the country as well as of individual fortune, while the Shintōists identify them with the Taoist 'palace of iridescent subtlety' (Shi-bi-kyū in Sino-Japanese), where the highest deity of Shintō, the 'eternal-ruling' (Minaka-nushi), is believed to reside. But this Shintō worship is of late origin; it was specially emphasized by a Shintō theorizer in the early part of the 19th century.

When Buddhism was introduced into Japan (6th cent.) and questions came up as to the relationship between the indigenous deities and the Buddhist pantheon, the Buddhist teachers tried to discover analogies between them and to explain that the Buddhist deities were the original noumena and the native ones their lateral manifestations. The most striking analogy was found between the sun-goddess and the aspect of Buddha's personality conceived in the sun-myth. The difference in gender concerned the syncretist but little, partly because the Japanese language had no genders and partly because the noumenon and the manifestation may take any sex. The result was an identification of the Japanese sun-goddess with Buddha Vairochana ('the illuminator'), and this conception exercised a wide influence on doctrine and worship during the sway of the syncretic Shintō from the 8th cent. down to the middle of the 19th, when the combination was dissolved by force. Among the theorizers of the syncretism we may cite one, Kanera (1402–81), who explained sun, moon, and stars as corresponding to the three insignia of the throne, *i.e.* the sun to the mirror, the moon to the jewel, and the stars to the sword.[1] This eclectic theory was backed by the popular conception of the 'three illuminating bodies' (*San-kō*) and their worship. People even nowadays regard a simultaneous appearance of the three as an auspicious occasion for worship and as a sign of special blessing to the country—*e.g.*, when on an autumn day the clear sky and the comparatively weak light of the sun cause the new moon and a certain star (Venus) to be visible to the eyes. Naturally, various configurations of the celestial bodies were used for methods of divination and predictions. In these methods Hindu, Persian, and Chinese elements may be detected, and their influence is still a living force among the mass of the people.

LITERATURE.—Besides the works cited in the footnotes, see M. Anesaki, *Japanese Mythology* (=vol. viii. of *The Mythology of All Races*), Boston, 1920.

M. ANESAKI.

SUN, MOON, AND STARS (Muhammadan).—I. *ASTROLOGY.*—1. Name.—Among the Muslims the technical name of astrology is *'ilm* (or *ṣinā'at*) *aḥkām an-nujūm*,[2] 'science (or art) of the decrees of the stars,' *'ilm al-aḥkām*, 'science of the decrees.' Sometimes, though rarely, in place of *aḥkām* its synonym *qaḍāyā* is found. Another name is *an-najāmah* (*nijāmah*) or *'ilm an-najāmah*. On the other hand, the names *'ilm* (*ṣinā'at*) *an-nujūm*, 'science (or art) of the stars,' *'ilm at-tanjīm*, mean astronomy as well as astrology, and they also mean both of these sciences taken together. The word *aḥkām* also signifies 'judgments,' 'judicial decisions'; accordingly the first of the denominations given above was in the Middle Ages translated in the Latin versions of Arabic works by *scientia judiciorum stell-*

[1] See *Nihongi: Chronicles of Japan*, tr. W. G. Aston (*Proc. Japan Soc. of London*, Suppl. to vol. i. [1896]), p. 18 f.; and, for the following stories, pp. 20, 32, etc.

[2] See *Koji-ki, or Records of Ancient Japan*, tr. B. H. Chamberlain (*TASJ*, Suppl. to vol. x. [1883]), pp. 42–44. This version is preserved also in *Nihongi*, p. 32, and, for its connexion with the conception of life and death, see art. LIFE AND DEATH (Japanese).

[3] *Nihongi*, p. 32.

[4] Aston, *Shinto*, London, 1905, p. 282 f., where the ritual to the goddess for harvest is cited.

[1] See art. PHILOSOPHY (Japanese), vol. ix. p. 870.

[2] As in the case of the other branches of scientific literature, so for astrology the Musalmān peoples made use of the Arabic language.

arum, and thence came the name of *astrologia judiciaria* or *astronomia judiciorum*, astrology, as opposed to *astrologia* (*astronomia*) *quadrivialis* (or *doctrinalis*), which is astronomy. Thus in the denomination of astrology among the Musalmāns there is a concept somewhat different from that contained in the Greek term [τέχνη] ἀποτελεσματική, 'science of the fulfilment [of astrological prognostications].' The astrologer is usually called by the same name as the astronomer, viz. *munajjim* (much more rarely *najjām*); sometimes, however, he is called by the special word *aḥkāmī* (plur. *aḥkāmiyyūn*, *aṣḥāb ṣināʿat al-aḥkām*). It was only in the 19th cent. that the distinction between *munajjim*, 'astrologer,' and *falakī*, 'astronomer,' was introduced into Arabic (at least in Egypt and in Syria).

2. Divisions.—The Muhammadans usually arrange the science of astrology under five principal heads:

(*a*) The fundamental principles of astrology, viz. the different divisions of the ecliptic, the properties of the various celestial places and of individual planets, the methods of determining the ascendant and the 12 celestial houses (*buyūt*, 'domus'), the planetary conjunctions, etc.

(*b*) Prognostics of a universal character (*al-aḥkām ʿalā umūr al-ʿālam*), viz. those which refer to the vicissitudes of kingdoms, dynasties, religions, and cities, to wars, epidemies, famines, winds, rains, the prices of goods, etc. This part of astrology, which Ptolemy calls ἀποτελεσματικὴ καθολική, 'universal apotelesmatics,' is usually called by the Arabs *taḥāwīl sinī al-ʿālam*, 'revolutiones annorum mundi,' since a great part of these prognostics is deduced from the planet which has the dignity of 'significator' (ἀφέτης, *dalīl*, *haylāj*) at the moment when the sun enters Aries, *i.e.* at the beginning of each tropic year. This universal part of astrology is subdivided into three sections: (i.) predictions drawn from the various kinds of planetary conjunctions (*qirānāt*, *iqtirānāt*), (ii.) predictions based on the 'revolutiones annorum mundi,' (iii.) predictions relating to the 'mutationes aëris' (*taghayyur al-hawā'*), *i.e.* to meteorological phenomena, and which are deduced from the lunar stations, or from the heliacal rising of Sirius, etc.

(*c*) Individual prognostications relating to the vicissitudes of individuals, derived from the planet or other celestial place which may happen to be the 'significator' at the moment of birth, and then from the 'significator' at each revolution of successive tropic years. This part of astrology Ptolemy calls γενεθλιαλογική, and the Arabs *al-mawālīd*, 'nativitates.'

(*d*) *Masāʾil*, 'interrogationes' (ἐρωτήσεις), or that part of astrology which is concerned with replies to questions, *e.g.*, the circumstances of a distant relative, the author of a theft, the hiding-place of a runaway slave, etc. The 'interrogationes' are always connected by the Muhammadan astrologers with the division of the heavens into 12 'domus.' The astrologers who follow the pure tradition of Ptolemy do not admit the 'interrogationes.'

(*e*) *Iḫtiyārāt*, 'electiones,' *i.e.* the choice of the propitious moment for doing any particular thing. The most common method is that of determining such a moment by seeking in which of the 12 celestial 'domus' the moon is found at that particular moment. This was also very probably the method employed by the Greeks; but along with this some Muhammadan astrologers use another method, of Indian origin (but also attributed to Dorotheus), which consists in deducing the fitting moment for action from the place which the moon then occupies in one of the 28 lunar stations or mansions (*manāzil*). The 'electiones' also are not admitted by the astrologers who follow Ptolemy's teaching.

3. Place among the sciences.—The science of the stars, says Ptolemy at the beginning of his *Tetrabiblos*, or *Quadripartitum*, consists of two parts: the first studies the appearances of the motions of the heavenly bodies either with respect to each other or with respect to the earth; the second seeks to deduce, from the physical qualities of those appearances, the changes which take place in the sublunar world. The first part is a science which stands by itself, and can be studied independently of the second; this, on the contrary, cannot do without the first. This conception that astrology is but the sister of astronomy, a branch, that is to say, of the 'science of the stars,' which in its turn is a part of 'mathematics' (*ʿulūm riyāḍiyyah*, *ʿulūm taʿlīmiyyah*, *taʿālīm*), is common to all the Musalmān astrologers and astronomers, and is accepted also by some philosophers (al-Fārābī in his *de Scientiis*, and the Iḫwān aṣ-ṣafā', or 'sincere companions' of the 10th cent. in their *Epistles*), by the author of the *Mafātīḥ al-ʿulūm*, or 'Encyclopædia of the Sciences' (10th cent.), and by the great historian philosopher Ibn Ḫaldūn (*Proleg.* lib. vi. cap. 13; M. G. de Slane's Fr. tr., Paris, 1862–68, iii. 122 f.).

Astrology, however, is classified in a different way by the majority of the philosophers. Musalmān writers commonly divide all science into two great categories: (*a*) sciences which relate to religious law (*ʿulūm shar'iyyah*), that is to say, in addition to theology and canon law, the learning which serves as an introduction to them, namely, grammar, lexicography, rhetoric, poetry, history, etc.; (*b*) intellectual or philosophic sciences (*ʿulūm ʿaqliyyah* or *ḥikmiyyah*), which the author of the *Mafātīḥ al-ʿulūm*, thinking of their origin, calls *ʿulūm al-ʿajam*, 'foreign sciences.'[1] The intellectual or philosophical sciences in their turn are for the most part divided into the three sections[2] already fixed by the later Greek peripatetics and by the Neo-Platonic expounders of Aristotle (*e.g.*, Ammonius, Simplicius, and Johannes Philoponus), namely: (*a*) metaphysic (*al-ḥikmah al-ilāhiyyah*, θεολογία, τὰ μετὰ τὰ φυσικά); (*b*) natural sciences (*al-ḥikmah aṭ-ṭabīʿiyyah*, 'natural philosophy,' φυσική); (*c*) mathematical sciences (*al-ḥikmah ar-riyāḍiyyah*, μαθηματική). These last correspond to the *Quadrivium* of Boethius, namely, arithmetic, geometry, astronomy, and music; on the other hand, the natural sciences are subdivided into eight fundamental parts, named for the most part after the titles of the corresponding Aristotelian works, namely: *Auscultatio physica*, *Generatio et corruptio*, *Cœlum et mundum*, *Meteoræ*, *Mineralia*, *Vegetalia*, *Animalia*, *de Anima*. Avicenna (*Fī aqsām al-ʿulūm al-ʿaqliyyah*, in *Tisʿrasāʾil*, Constantinople, 1298 A.H. [=A.D. 1881], p. 71 ff.), Muḥammad al-Akfānī as-Saḥāwī (*Irshād al-qāṣid*, ed. A. Sprenger, Calcutta, 1849; the author died in 749 A.H. [=A.D. 1348]), Ḥājjī Ḫalīfah (in the introduction to his *Lexicon bibliographicum et encyclopædicum*),[3] and others consider astrology as one of the 7 (or 9) *furūʿ*, 'secondary branches' of the natural sciences, placing it, that is to say, beside medicine, physiognomy, interpretation of dreams, alchemy, the science of talismans, etc. This same classification of the natural sciences is found in al-Ghazālī († 505 A.H. [=A.D. 1111]), who, in his *Taḥāfut al-*

[1] Each of these two great categories afterwards gives place to the distinction between theoretical (*naẓariyyah*) and practical (*ʿamaliyyah*) science—a distinction which has its origin in Aristotle (E. Zeller, *Die Philosophie der Griechen*[3], Tübingen, 1875–81, II. ii. 177).

[2] Other divisions, indicated in the writings of the Iḫwān aṣ-ṣafā', in the *Mafātīḥ al-ʿulūm*, etc., are useless for our present purpose.

[3] Ed. G. Flügel, 8 vols., London, 1835–58.

falāsifah, Cairo, 1319 (1901), p. 63 f., refers to it as common amongst the Musalmān peripatetics, and approves of it.

Averroës, in the *Tahāfut al-tahāfut*, Cairo, 1319 (1901), p. 121, admits, as corresponding to Aristotelian teaching, the eight fundamental parts of the natural sciences; but he denies that the so-called derived branches are sciences. Medicine, he says, is an art (*ṣinā'ah*) and not a science; it has a practical and not a theoretical character; accordingly astrology is included in the same category with divination from the flight of birds and from the movement of quadrupeds (*zajar*), with divination in the form of vaticinations (*kahānah*), with physiognomy and with the interpretation of dreams, all being arts which have as their aim the prediction of the future, but which 'are not sciences either theoretically or practically, however it may be supposed that one may sometimes derive some practical advantage from them.'

A curious classification is found at the beginning of the unedited book *de Interrogationibus* (*Fī'l-masā'il*) of the astrologer Ya'qūb al-Qaṣrānī, who lived in the 3rd cent. A.H. (9th A.D.). According to the catalogue of the Arabic MSS of Berlin (W. Ahlwardt, *Verzeichniss der arab. Handschriften*, Berlin, 1887–99, v. 275, no. 5877), he maintains three degrees (*marātib*) of science: theology, medicine, science of the stars; the last, being based not on observation, but on deduction from analogy, occupies a place between the other two.

4. Sources.[1]—(*a*) *Greek.*—These are represented by the classic (if we may call it so) astrology of the *Tetrabiblos* or *Quadripartitum* of Ptolemy; by the writings of Dorotheus Sidonius (1st cent. A.D.), which go back to the Græco-Egyptian tradition; by the great eclectic compilation of Vettius Valens (2nd cent. A.D.);[2] by the book on the 'decani,' the 'interrogationes,' and the nativities of Antiochus of Athens (2nd or 3rd cent. A.D.), which appears especially to follow the Babylonian tradition; by the Καρπός, or *Centiloquium*,[3] falsely attributed to Ptolemy; by some works ascribed to the mythical Hermes;[4] and by an author whose name (Rīmos?, Zīmos?) is cited by Arabic writers in a form so corrupt as to be unrecognizable. Of another Greek writer, Teucer or Teucrus of Babylon, the Arabs had knowledge through Iranian sources.

(*b*) *Indian.*—The Musalmān writers mention seven or eight Indian astrologers, whose names, however, it has not as yet been possible to identify with the corresponding Sanskrit. The most important is K.n.k.h or K.t.k.h, who, according to some Arabic writers, appears to have come to Baghdād to the court of the khalīf al-Manṣūr, bringing thither astronomical books of India, and, according to others, making known Indian arithmetic. The Arabs attribute to him writings on the *numūdār* (that is, on the method of ascertaining a factitious ascendant of the nativity), on the nativities, and on the conjunctions of the planets; it is therefore plain that he had also treated of the part of Indian astrology called in Sanskrit *horā* or *jātaka*, which arose through Greek influence. This confirms a conjecture of F. Boll (*Sphaera*, Leipzig, 1903, p. 414 f.), who, from the citations contained in the *Introductorium* of Abū Ma'shar (or Albumasar), infers that K.n.k.h had before him materials of distant Greek origin for his representation of the figures arising in the heavens together with the 'decani.' But in general, Musulmān astrologers cite simply 'the Indians' (*al-Hind*), without particular names of authors. We must further add that the influence of Indian astrology made itself felt sometimes through Iranian writings and oral teaching, as is apparent from some Indian words which have passed into Arabic terminology in an Iranian form—*e.g.*, *darījān* (Ind. *drekkāṇa*).

(*c*) *Iranian.*—These are in the Pahlavī language or Middle Age Persian. The writings of Teucrus of Babylon (second half of the 1st cent. A.D.) on the figures arising in the heavens together with the 'decani' reached the Arabs through a Persian version, where the name of the author, on account of the ambiguity of the Pahlavī writing, was afterwards spelt by the Persians and Arabs Tīnkalūs (also Tankalūsh or Tankalūshā); so that in the *Introductorium* of Abū Ma'shar his teachings were given as 'teachings of the Persians' (*madhhab al-Furs*) and contain also some Persian names of constellations (cf. Boll, p. 415 f.). Another source was Buzurjmihr's commentary on the astrological Ἀνθολογίαι of Vettius Valens; the Pahlavī translation of the Greek title was *vizīdhak*, 'selected,' which became in Arabic *al-bizīdhaj* and was afterwards variously and strangely corrupted by Arabic writers.[1] The Musalmāns also cited as a source of astrological teachings the mythical Zoroaster (Zarādusht in Arabic writings, Zardusht in modern Persian writings), whose name indeed was already frequently found in Greek astrology of the 4th and following centuries. A fourth source is the book on 'nativities' of [al-]Andarzghar, son of Zādānfarrūḫ; but we lack information about this personage, whose name is corrupted into Alendezgod in the Latin version of Alcabitius (al-Qabīṣī), and into Andruçagar in the Latin version of the book of the Jew Ibn 'Ezrā on nativities (which always draws on Arabic sources). Those astrological writings which are ascribed by the Arabs to Jāmāsp the Wise (the trusted counsellor of the mythic king Gushtāsp) seem to be late Muhammadan falsifications.

We do not know exactly when all these works hitherto mentioned were first translated into Arabic, but it is certain that the great majority of them were known in the second half of the 8th cent. A.D., that is, when Musalmān culture began. If the indication placed at the end of the unedited *'Arḍ miftāḥ an-nujūm* of Hermes (MS in Biblioteca Ambrosiana in Milan) is true, this book would seem to have been translated in the month Dhū 'l-qa'dah, 125 A.H., namely, in September 743 A.D., while the Umayyad khalīfs were still reigning. The first version of the *Tetrabiblos* is due to Abū Yaḥyā al-Baṭrīq, a translator of the time of al-Manṣūr, the second 'Abbāsid khalīf (136–158 A.H. [A.D. 754–775]); Dorotheus and Antiochus are already mentioned in the writings of Mā shā' Allāh (Messahala) in the second half of the 8th cent.; all the other Greek authors mentioned above are amply cited by the astrologers of the 9th century. As has already been said, the writings of the Indian K.n.k.h seem to have been known at Baghdād in the time of the khalīf al-Manṣūr; and about the middle of the 9th cent. we have already several small astrological works of al-Kindī (Alchindus) formed expressly on Indian models. It is almost certain that the Persian books were translated by members of the family

[1] For details see the present writer's Arabic lessons on the origins of astronomy among the Arabs (*'Ilm al-falak, ta'rīḫuhu fī 'l-qurūn al-wusṭā*, Rome, 1911–12), pp. 189–215 (Iranian sources), 216–220 (Greek sources), etc.

[2] Muhammadan astrologers were also acquainted with the *Anthologiæ* of Vettius Valens through an Arabic translation of a Pahlavī version; cf. below, under (*c*).

[3] The Arabic tr. is rather a paraphrase, which attempts to interpret the theories obscurely indicated in the Greek text.

[4] Some of the works attributed to Hermes seem to be Musalmān falsifications—*e.g.*, the book *de Revolutionibus nativitatum*, which has reached us in a Latin translation.

[1] In the Latin version of Albohazen Haly filii Abenragel, *De iudiciis astrorum*, Basel, 1571, the name of the book is *Yndidech* (p. 149, col. b), *Enzirech* (p. 176, col. a), *Endenadeyg Persarum* (p. 347b), *Endemadeyg Persarum* (348b), *Andilarehprosu* (404b).

Nawbaḫt, known by their translations from Pahlavī into Arabic (cf. *Kitāb al-Fihrist*, pp. 244, 274), whose head was astrologer at the court of al-Manṣūr; and in any case the antiquity of Iranian influence in astrology is attested by the fact that in the works of Mā shā' Allāh, according to the Latin translation of John of Seville, technical terms of Iranian origin are freely used: *e.g.*, *alhyleg* (*alhaylāj*), *alcochoden* (*al-kadḫudāh*), *alimbutar* (*al-jānbaḫtān*).

Side by side with the written sources there was, without doubt, the oral tradition of the peoples converted to Islām.[1] Among the Syrians Christianity had almost suffocated astrology, although Bardesanes (154–222) had reconciled Christian dogma with an attenuated form of predestination by means of the stars; all the same we know that at Ḥarrān, the ancient Carrhæ, special astrological traditions flourished along with other pagan sciences. It is further probable that Theophilus, son of Thomas, a Christian of Edessa who was astrologer of the khalīf al-Mahdī (A.D. 775–785), and who has been cited by several Musalmān astrologers as an authority on the subject of 'electiones,' again took up with Syrian oral tradition. In the same manner it is natural that there were absorbed into Musalmān culture the astrological beliefs and practices of the Aramaic centres (tending to paganism) of Mesopotamia and Babylonia, of the Egyptians, etc. Finally, we must not forget the Judaic element which had a notable part in the first ages of Musalmān astrology; in fact, among the principal writers on astrological matters in Arabic in the 2nd and 3rd centuries of the Hijra are the Jews Mā shā' Allāh, Sahl ibn Bishr, Rabban aṭ-Ṭabarī, and Sanad ibn 'Alī.

5. Special character.—The civilized peoples over whom the Arabic domination of the 7th, 8th, and 9th centuries extended, viz. Greeks, Copts, Syrians, Persians, and Indians, had already imagined all the possible fundamental combinations concerning the influence of the stars over mundane events; consequently it was impossible for the Musalmān astrologer to find out anything substantially new. On the other hand, the principal justification of astrology consisted precisely in presenting itself as the jealous preserver of that which an age-long experience had taught the wise of preceding generations. The office of the Musalmān astrologers consequently was reduced to a choosing of what seemed suitable among the many principles and methods of their predecessors, and at times to a harmonizing of elements of very diverse origin, amplifying and completing particular points on which it was easy to give free rein to fancy. All this, as we have said, was done with the widest eclecticism. But, though nothing really original is met with in the field of apotelesmatics properly so called, there is, all the same, a point on which Arabo-Musalmān astrology is far superior to other astrologies, including the Greek, and represents a real progress. This consists of a wide and continued application of spherical astronomy and of exact mathematical processes to the methods of astrological research. Among the Greek astrologers the calculations are very rough; arcs of the ecliptic are substituted for arcs of the equator, right ascensions for oblique ascensions; rough tables, useful for a determined terrestrial latitude, are also employed for different latitudes; the latitudes of the planets are neglected in the calculation of the radiations ('projectiones radiorum,' *maṭāriḥ ash-shu'ā'*). Among the Greeks we seek in vain for a clear exposition of the method of determining mathematically the 12 heavenly 'domus,' which, however, form one of the hinges of the astrological system. Ptolemy himself, teaching minutely in the *Tetrabiblos* how the 'directio' (*ἄφεσις*) is calculated, completely neglects the latitude of the planets. Characteristic is the fact that Ptolemy, in the *Almagest*, occupies himself with three problems useful only to astrologers (inclination of the shadow of the eclipses with respect to the ecliptic and to the horizon, position of the stars with respect to the sun in consequence of the daily motion of the sphere, appearances and occultations of the planets with respect to the solar rays), and which even in astrology are of very small importance; and, on the other hand, he does not make the slightest allusion to other problems of spherical astronomy which would be of capital importance for apotelesmatics. Musalmān astronomers, on the contrary, teach exact calculations, and often even prepare tables for all the mathematical problems required by astrology: determination of the 12 celestial houses, 'directio,' 'revolutiones annorum,' 'profectio,' 'projectio radiorum.' Thus astrology, among the Musalmāns, becomes an art which demands a solid scientific preparation, and which tends to give an ever greater mathematical complication and exactness to its methods of research among celestial phenomena. *E.g.*, the *mamarr* ('passage [of one planet over another],' *almanar*, or 'supereminentia,' of our astrologers) corresponds exactly from an apotelesmatic point of view to the *καθυπερτέρησις* of the Greeks; but whilst for the Greeks this takes place when a planet is situated to the west of another, viz. has a lesser longitude, for the Arabs the *mamarr* takes place when a planet in its own epicycle is distant from the apogee of the epicycle less than another planet is distant from the apogee of its own epicycle. Consequently, its calculation in Musalmān astrology is not a light matter, and requires the employment of complete planetary tables. We can understand, therefore, why the theory of the *mamarr* of the planets is not only expounded in several treatises of spherical astronomy, but has also given rise to special monographs. The importance of all this is plain: in the Hellenistic world astrology flourishes while astronomy decays; in the Musalmān world of the Middle Ages astrology becomes a potent ally of mathematical and observational astronomy.

6. Polemic concerning astrology.—From Islām astrology at first had a much less unfavourable reception than from Christianity. The latter had to combat in the teachings of astrology an entire world of pagan ideas and cults; it had to contend against the concept of necessity, which excluded Christian free will. In the 7th and 8th centuries A.D., however, the pagan elements of astrology were completely modified; they were so entirely hidden under a verbal formalism as to be no longer recognizable; and, on the other hand, orthodox Islām, with its doctrine of predestination, which excluded the freedom of human actions, was, at bottom, not very far removed from the *εἱμαρμένη* of the Stoics and of many astrologers of antiquity. When we consider that the first Musalmān theologians took no heed whatever of the sciences which did not appear to have any relation to the religious content of Islām, we easily understand how astrology had been able to advance unimpeded through its first stages almost up to the end of the 2nd cent. of the Hijra. It is not, therefore, astonishing that Abū Ma'shar, writing his *Introductorium* in 848 A.D., among the ten categories of persons hostile to astrological teaching, makes no mention whatever of opponents influenced by strictly religious reasons,[1] and he makes his defence of astrology to consist (*Introd.* I. 5, fol. b 2 v.–b 3 v.) only in an amplification of the arguments with which Ptolemy (*Tetrab.* I. 3)

[1] Cf. Nallino, *'Ilm al-falak*, pp. 326–332.

[1] *Introductorium*, I. 4 (Augsburg, 1489, fol. a 7 v.–b 2 v.).

had already maintained the material and moral advantages of foreseeing the future, even if this should appear to be adverse to us. The 'philosopher of the Arabs,' al-Kindī, who died a little after 870 A.D., regards astrology as an integral part of philosophy (*ḥikmah, falsafah*); he seeks its basis not only in the four mathematical, but also in the physical and metaphysical doctrines;[1] and he opposes it to many popular prejudices. Al-Kindī was perhaps the only one who endeavoured to reduce to a completely rational and systematic form the principles and the methods of astrology.

But matters soon underwent a change. Towards the end of the 2nd cent. of the Hijra the knowledge of Aristotle's teaching grew more definite and profound, and in this there was no place for astrology; hence the philosophers commenced to make war against it. On the other hand, the theologians were not slow to see in the influence attributed to the stars over human actions a menace to the severely monotheistic conception of Islām, more especially when later on there filtered into Musalmān theology an opposition to the idea of necessary causality, and the atomistic doctrine of continued creative acts became more prevalent. Moreover, the daring predictions concerning the duration of Islām[2] became an evident danger to dogma. Thus the polemic against astrology became very acute.[3]

The most ancient confutation which we possess is that of Abu 'l-Qāsim 'Īsā ibn 'Alī,[4] drawn up in the first half of the 10th cent.,[5] and preserved in a work of the Ḥanbalite theologian, Ibn Qayyim al-Jauziyyah, *Miftāḥ dār as-sa'ādah*.[6]

After an exordium in which he admits that the stars may have some influence on such natural phenomena as climate and temperament, but denounces the practice of foretelling the future by their means, he divides his dissertation into three distinct parts. The first has reference to the discordance among astrologers as to their fundamental principles concerning the nature of the influence of the stars, and an exposition follows of several fundamental principles for astrological calculations on which the various writers disagree—*e.g.*, the method of determining the planetary 'termini,' the 'significator' (*dalīl, ἀφέτης*), the 'pars fortunæ,' the male and female zodiacal signs. The second part consists of the examination of many principles which are affirmed by the astrologers, but which are repugnant to good sense (*mustabsha'*). In the third part 'Īsā ibn 'Alī cites some of the arguments adopted by the astrologers in favour of their science, and refutes them.

Contemporary with 'Īsā ibn 'Alī is the famous philosopher al-Fārābī (*q.v.*; † A.D. 950), who, as a profound student of Aristotle, could not but be opposed to astrology. We have a work of his against astrology,[7] which, however, is not so vigorous a confutation as we should have expected from such a philosopher and contains some childish reasonings. This is explained by the fact that the work is merely a series of notes, published by a disciple just as he found them.

The philosophers contemporary with al-Fārābī did not all share his hostility to astrology; in fact the schools which had been less subject to Aristotelian influence favoured it, as was already the case with al-Kindī.

With reference to this a special place is held by the Iḫwān aṣ-Ṣafā', 'Sincere Companions,' who flourished in al-Baṣrah towards A.D. 950–960, and whose writings set forth the philosophic doctrines of the heretical Bāṭinites, a branch of whom were the Carmaṭians (al-Qarāmiṭah), who towards the end of the 3rd cent. A.H. (9th cent. A.D.) caused political disorders in the 'Irāq, and who founded an independent kingdom in N.E. Arabia which lasted until after A.H. 474 (A.D. 1081–82). The Carmaṭians had reaped great advantage from astrological predictions based on the theory of the great planetary conjunctions.[1] One can therefore understand that the Iḫwān as-Ṣafā' not only admitted, with Aristotle and other Arabic philosophers, that the changes (generation and corruption) of the sublunar world were consequent upon celestial movements but also that the planets foretell the future and have a direct influence upon the will and the moral character. The great encyclopædic work of the Iḫwān is imbued with those astrological ideas, among which the theory of planetary conjunctions occupies the principal place.

Favourable to astrology also are those other philosophers who lead up to Abū Sulaimān Muḥammad ibn Ṭāhir ibn Bahrām as-Sijistānī al-Manṭiqī, who, in the second half of the 10th cent., gathered about him at Baghdād a number of learned men for the purpose of discussing various subjects. Notes and summaries of many of these discussions were collected in the *Kitāb al-muqābasāt* of Abū Ḥayyān at-Tawḥīdī, a philosopher, mystic, and jurist († after 400 A.H. [A.D. 1009–1010]), about whose orthodoxy there is some suspicion. A record of a meeting in reference to astrology is preserved almost entire in the work already cited of Ibn Qayyim al-Jauziyyah.[2] Some of those present had attacked astrology, declaring it to be useless, since, after so much study and effort on the part of its supporters, it does not succeed in modifying those events which overwhelm both the wise astrologer and the ignorant man. There then rose up several questioners to refute these accusations, and they set themselves specially to explain how predictions can fail in spite of the truth of astrology, and that, in any case, the efforts of astrologers to discover the truth are always noble. Their defence of practical astrology is somewhat weak, and is probably the last that has been made in the field of philosophy.

Avicenna (*q.v.*; † 428 A.H. [A.D. 1037]) contends against astrology, not only in his great encyclopædia, *ash-Shifā'*, 'The Recovery of the Health [of the Soul],' and in the *an-Najāh*, but also in a special work of which a full résumé was made by Mehren.[3] He demonstrates that astrology has no foundation, and proceeds to show that, even admitting its theoretical truth, it would be impossible for men to acquire a knowledge of it.

Averroës (*q.v.*), or Ibn Rushd († 595 A.H. [A.D. 1198]), is also a decided adversary of astrology, as appears from the severe judgment referred to above (§ 3) and from some passages of his comments on Aristotle. But it would be useless to continue the review of the philosophers, who after the 10th cent. A.D. are all in agreement on this question. It is more interesting to consider the position taken up by the theologians, who—from the motives indicated at the beginning of this section—engaged, towards the end of the 9th cent. A.D., in a relentless war against astrological theories.[4]

We have already seen the attitude of al-Jubbā'ī. We may add here that Ibn Ḥazm († 456 A.H. [A.D. 1064]), who fiercely opposed the scholastic or speculative theology of al-Ash'arī in Spain, gives his ideas on astrology in *Al-Fiṣal fī 'l-milal wa 'l-ahwā' wa 'n-niḥal*.[5] He divides those who believe that the future can be foretold by means of the stars into two classes: (1) misbelievers and polytheists, and (2) persons who are in error. The first are those who maintain that the stars and the

[1] Cf. the quotations in M. Steinschneider, *ZDMG* xviii. [1864] 134; and chs. x. and xi. of the anonymous Latin pamphlet *De erroribus philosophorum* (written in the second half of the 13th cent.), ed. P. Mandonnet, *Siger de Brabant*², Louvain, 1908–11, pt. ii. pp. 18–21.

[2] *E.g.*, Theophilus, son of Thomas, the astrologer of the third 'Abbāsid khalīf (see above, § 4), maintained that the reign of Islām would last only 960 years (Ibn Ḫaldūn, *Proleg.*, lib. iii. ch. liv., tr. de Slane, ii. 222 f.). The philosopher al-Kindī calculated that the duration of the kingdom of the Arabs would be 693 years (see O. Loth, 'Al-Kindi als Astrolog,' in *Morgenländische Forschungen, Festschrift an H. L. Fleischer*, Leipzig, 1875, pp. 263–309).

[3] Men like al-Jāḥiẓ († 255 A.H., 869 A.D.) and the famous theologians al-Jubbā'ī († 303 A.H., 915–916 A.D.) and al-Ash'arī († 324 A.H., 936 A.D.) were declared enemies of astrology.

[4] According to Ibn al-Qifṭī, ed. Lippert, p. 244 f., he died on Friday, 28 Rabī' ii., 395 A.H., *i.e.* 28th March, 1001 A.D.; cf. also *Fihrist*, p. 129.

[5] It is, in fact, cited in the preface of the *Libellus isagogicus ad magisterium judiciorum astrorum*, which al-Ṣaḥṣī had written for Saif ad-daulah, prince of Aleppo, who reigned from 333 to 356 A.H. [A.D. 944–967].

[6] Cairo, 1323–25 A.H. [A.D. 1905–07], ii. 156–196.

[7] Al-Fārābī, *Philosophische Abhandlungen*, tr. F. Dieterici, Leyden, 1892, pp. 170–186 (pp. 104–114 of the text published in 1890). Dieterici at some points has not understood the meaning of some technical terms of astrology, so that his version is not always perfect.

[1] Cf. M. J. de Goeje, *Mémoire sur les Carmathes du Bahraïn et les Fatimides*², Leyden, 1886, pp. 115–129.

[2] ii. 185–193.

[3] A. F. Mehren, 'Vues d'Avicenne sur l'astrologie,' *Muséon*, iii. [Louvain, 1884] 383–403, reprinted in 'Homenaje á D. Francisco Codera,' *Estudios de erudición oriental*, Saragossa, 1904, pp. 235–250.

[4] See also a brief account by I. Goldziher, 'Stellung der alten islamischen Orthodoxie zu den antiken Wissenschaften' (*ABA* W', 1915), pp. 20–25.

[5] Cairo, 1317–21 A.H. (A.D. 1899–1903), v. 37–40.

heavenly spheres are intelligent beings, agents, of eternal duration, and disposing of earthly things either with or without God. The second are those who hold that the stars and the celestial spheres, whilst without intelligence, have been created and established by God as indicators of things which are to take place.

The preserver of Ash'arite dogmatic theology, **al-Ghazālī** († 505 A.H. [A.D. 1111]), opposes astrology in his *Iḥyā' 'ulūm ad-dīn*, 'The Revival of Religious Sciences.'[1] And the same attitude we find in the books of the famous Ḥanbalite, Ibn Taimiyyah († 728 A.H. [A.D. 1328]).[2]

But the most vigorous and complete confutation of astrology is contained in the *Miftāḥ dār as-sa'ādah* of Ibn Qayyim **al-Jauziyyah** († 751 A.H. [A.D. 1350]),[3] one of the most noted theologians of the Ḥanbalite school. Only the famous work of Pico della Mirandola, *Adversus astrologiam*, can be compared to the 110 closely printed quarto pages of the confutation written by this Muhammadan theologian, whose impassioned polemics press upon the adversary with an infinity of subtle distinctions which prove the force of his dialectic.

In the theological world perhaps the sole defender of astrology is **Faḫr ad-dīn ar-Rāzī** († 606 A.H. [A.D. 1210]), cited above. Famous especially for his great commentary on the Qur'ān, he composed also many theological, philosophical, and astrological works, and studied medicine and mathematics. Without doubt his confidence in astrology is due to his cultivation of the sciences, and this confidence already appears in his commentary on the Qur'ān.

No theologian seems to have followed Faḫr ad-dīn ar-Rāzī in his bold interpretations of Qur'ānic passages and of religious traditions. Besides, after the writings of Ibn Qayyim al-Jauziyyah and his predecessors, polemics about astrology could no longer reckon on any novelty of argument. The considerations developed by the great philosopher of history, **Ibn Ḫaldūn** († 808 A.H. [A.D. 1406]), in his historical *Prolegomena*,[4] are alone deserving of notice.

7. **Astrology in common life.**—The four orthodox schools of jurisprudence and the Shī'ite school were already in existence when the war of the philosophers and theologians against astrology became fierce; accordingly, the anathema launched against it in the name of religion did not occupy much space in Muhammadan law, notwithstanding the fact that this had its chief foundation in religious doctrine. Among some jurists of a rather later age, however, we meet with open hostility to astrology. In Muhammadan law the buying and selling of useless things is forbidden; therefore some jurists[5] teach that one may not sell or buy books of astrology. Another legal prescript does not admit the testimony of misbelievers; therefore some jurists, regarding the astrologer as a misbeliever, deny him the right of acting as a witness.[6] But, before theological anathema smote it, astrology was deeply rooted among all lay classes of society. The courts of the 'Abbāsid khalīfs at Baghdād and of the numerous small dynasties which arose in the Muhammadan world after the 3rd cent. of the Hijra received astrologers with great favour and consulted them on affairs of State as well as on trifling matters of daily life. At the foundation of Baghdād in A.D. 762, and at that of al-Mahdiyyah (in Tunis) in 916, the astrologers, summoned for the purpose, indicate the propitious moment for beginning the work. Many writings on apotelesmatics are dedicated to khalīfs, sultans, and princes. In Turkey, even at the beginning of the 19th cent., one of the chief posts at court was that of *munajjim-bāshī*, or chief astrologer; and the case was similar in Persia, in India, and in Muhammadan central Asia.[1] In the *Thousand and One Nights* not only is the astrologer with his astrolabe mentioned several times (*e.g.*, Nights 28 and 50 of the Egyptian edd.), but there is also a complete dissertation on the elements of astrology (Nights 254–257, in the story of the slave girl Tawaddud). Further, the considerable number of old Arabic astrolabes still existing in the East and in South Europe would alone suffice to prove the great diffusion of astrology throughout the Muhammadan world; and it found strong support among the students of astronomy. Cases of persecution of astrologers by the State are extremely rare. Al-Ḥākim, Fāṭimid khalīf of Egypt, who in 404 A.H. (A.D. 1013–1014) prohibited the study of astrology and banished from Cairo those who cultivated it, was an astrologer himself, and that decree of his is one of many acts of madness committed in the last years of his life.

In the Muhammadan countries into which European civilization has penetrated (which with the Copernican system has destroyed the bases of apotelesmatics) astrology has lost its importance and remains the monopoly of the popular classes, among whom it has degenerated into a form of prediction without any serious mathematical and astronomical basis. On the other hand, in countries where there is little or no European influence (*e.g.*, in many parts of Morocco) apotelesmatics still flourish, but accompanied by only rudimentary astronomical knowledge. To-day in S. Arabia the function of the astrologer is exercised especially by the *qāḍī*,[2] *i.e.* by those whose duty it is to see that canon law is observed!

8. **Influence on European astrology.** — The astrology of the Latin Middle Ages from the beginning of the 12th to the end of the 15th cent. is really Arabic astrology. Its sole sources are Arabic (Albohali, Albohazen, Albumasar, Alcabitius, Alchindus, Almansor, Alphadol, Aomar, Gergis, Hali, Haly Heben Rodan, Messahala, Zahel, and some pseudepigraphical works), or at least translations from Arabic (*e.g.*, the *Tetrabiblos* or *Quadripartitum* of Ptolemy, and the Καρπός or *Centiloquium*); the technical terminology is literal translation or mere corruption of Arabic words. In the 16th cent. the humanists rescued from oblivion the poem of Manilius and the crude compilation of Firmicus Maternus; but this was a mere literary exercise of no importance for the astrology of the 17th century.

In the Byzantine world also Muhammadan astrology leaves deep traces in many versions from the Arabic and from the Persian;[3] so that side by side with the works derived from the classic Greek authors appear those of Ἀπομάσαρ (Abū Ma'shar), Ἀχμέτ (Aḥmad ibn Yūsuf ibn ad-Dāyah), Μεσσάλα (Mā shā' Allāh), Σέχλ (Sahl ibn Bishr), and other Arabic writers. Thus there frequently occur in Byzantine astrological writings Arabic and Persian names of planets or technical terms which no longer correspond to those of classical Greek.

[1] Cairo, 1302–03 A.H. (A.D. 1885–86), i. 27 f. All this passage is copied without indication of its source in ad-Damīrī, *Ḥayāt al-ḥayawān*, Cairo, 1311 A.H. (A.D. 1893), i. 12 f., *s.v.* 'Asad.'

[2] *Majmū'at al-fatāwā*, Cairo, 1326–29 A.H. (A.D. 1908–11), i. 323–336.

[3] Ed. Cairo, 1323–25 A.H. (A.D. 1905–07), ii. 132–240.

[4] Bk. vi. ch. 26 (tr. M. G. de Slane, iii. 240–249).

[5] *E.g.*, al-Bājūrī, *Ḥāshiyah 'alā Ibn Qāsim al-Ghazzī*, Būlāq, 1292 A.H., i. 445.

[6] Cf. the quotations in Saḥnūn ibn 'Uthmān al-Wānsharīsī, *Mufīd al-muḥtāj fī sharḥ as-sirāj*, Cairo, 1314 A.H., p. 5.

[1] Cf. *e.g.*, F. Bernier, *Evénements particuliers des états du Mogol*, Paris, 1671, p. 96. See also J. T. Reinaud, *Monumens arabes, persans, et turcs*, Paris, 1828, ii. 367 f. For Persia see *Voyages du chevalier Chardin en Perse, et autres lieux de l'Orient*, new ed., Amsterdam, 1735, i. 242, iii. 163–165, 174–183.

[2] R. Manzoni, *El Yèmen*, Rome, 1884, p. 209; H. von Maltzan, *Reise nach Südarabien*, Brunswick, 1873, p. 164.

[3] The Arabs and the Persians are called indifferently Πέρσαι.

Finally, the Jewish astrological literature of Europe, in which a conspicuous place is occupied by the works of Abrāhām ibn 'Ezrā († 1167), is based exclusively on Arabic sources.

LITERATURE.—There is no work setting forth the content and history of Muhammadan astrology. For biographical and bibliographical notices of individual astrologers reference may be made to H. Suter, *Die Mathematiker und Astronomen der Araber und ihre Werke*, Leipzig, 1900 (completed in 'Nachträge und Berichtigungen zu "Die Math. und Astron.,"' in *Abhandlungen zur Gesch. der mathematischen Wissenschaften*, xiv. [1902] 157–185). The mathematical side of Muhammadan astrology and the explanation of several technical terms are set forth in the present writer's annotations on al-Battānī, *Opus astronomicum*, 3 vols., Milan, 1899–1907. Beyond two or three small pseudepigraphical writings of no importance, printed or lithographed in Cairo, and the dissertation of al-Kindī published by O. Loth (see above, p. 92[a], n. 2), there are no edd. of complete astrological works in the original text; there are, on the other hand, edd. of Middle Age Latin versions (15th–16th cent.), several of which have been cited in the course of the article.

II. *ASTRONOMY.*—1. Name.—The names *'ilm* (or *ṣinā'at*) *an-nujūm*, 'science (or art) of the stars,' *'ilm* (or *ṣinā'at*) *at-tanjīm* denote both astronomy and astrology. For the former science Averroës[1] adopts the expression *ṣinā'at an-nujūm at-ta'ālīmiyyah*, 'mathematical art of the stars,' which is found also in the original Arabic of the *de Scientiis* of al-Fārābī, where Gerard of Cremona translated it by 'astronomia doctrinalis,' misled by the double signification of the adjective *ta'ālīmī*. The astronomy of observation is designated by Averroës[2] *ṣinā'at an-nujūm at-tajrībiyyah*, 'experimental art of the stars.' Special names of astronomy are *'ilm al-hay'ah*, 'science of the form [of the universe],' and *'ilm al-aflāk*, 'science of the celestial spheres.'[3] The branch of astronomy which deals with the construction and use of instruments for determining the time, especially for the purpose of regulating the times of the religious services in the mosques, is named *'ilm al-mīqāt*, 'the science of the time appointed [for the canon prayers],' and he who cultivates it is called *muwaqqit*.

2. Scope.—The Greek and Muhammadan conception of astronomy does not exactly correspond to the modern conception.

Al-Fārābī says in his treatise *de Scientiis*[4] that astronomy has for its object the study of the celestial bodies and of the earth from these three points of view: (*a*) number, figure, order, and respective position of the spheres and of the celestial bodies; their magnitudes and distances from the earth; immobility of the earth; (*b*) celestial motions and their consequences with regard to the stars themselves (conjunctions and oppositions, eclipses, etc.); (*c*) magnitude of the inhabited part of the earth and its division into zones or climates; determination of geographical co-ordinates; effects of the rotation of the celestial sphere in regard to parts having different latitudes (varying length of the day, right and oblique ascensions of the points of the ecliptic, etc.). This scheme of the content of astronomy is found also in later writers,[5] with the sole difference that the study of the magnitudes and distances of the celestial bodies and spheres comes to be considered under a category (*d*) separate from (*a*).

According to Avicenna, the astronomer studies 'the parts of the universe as far as regards their figure, their respective positions, their magnitudes, and their distances from each other; he further studies the motions of the spheres and of the celestial bodies, the estimate (*taqdīr*) of the globes, of the axes (*l. quṭūb*) and of the circles [ideal] on which those motions take place. All this is contained in the *Almagest*.'[6]

The limits of astronomy are well defined by Ibn Ḫaldūn († A.D. 1406):

Astronomy consists of the study of the celestial bodies and motions as they appear to us; 'it is a most noble science, but it does not give, as is often supposed, the form of the heavens and the disposition of the spheres and of the stars as they are in reality. It only indicates that from those motions there result for the spheres these forms and these dispositions. Now, as is known, it is not strange that from one and the same thing there should result necessarily two different things; therefore, when we say that those motions give as a result [those celestial configurations], we seek to argue the mode of existence of the result by means of the necessary cause; a proceeding which does not at all guarantee the truth. Nevertheless, astronomy is an important science, indeed one of the fundamental parts of the mathematical sciences.'[1]

The diversity of criteria and of purposes by and for which the physicist ('naturalis') studies celestial phenomena, in contrast to the astronomer ('astrologus'), is shown also in a passage of Averroës.[2] This conception of the philosophers is shared by the Muhammadan astronomers, for whom astronomy embraces spherical astronomy (with the theory of instruments), mathematical chronology, spherical trigonometry, and geography as based on mathematics (like that of Ptolemy); and it excludes all that for us would enter into the field of stellar physics and celestial mechanics. This is evident from the summary[3] of the best systematic treatise on Muhammadan astronomy, viz. the unedited *al-Qānūn al-mas'ūdī*, composed in Arabic by al-Bīrūnī († A.D. 1048):

(*a*) General notions and fundamental hypotheses for the geometrical representation of celestial phenomena; (*b*) mathematical chronology, conversion of one era into another, festivals of various peoples; (*c*) spherical trigonometry; (*d*) circles of the celestial sphere and systems of co-ordinates; phenomena of the diurnal motion of the sphere with reference to the earth (amplitudes, solar altitudes, right and oblique ascensions of the points of the ecliptic, etc.); (*e*) form, dimensions, etc., of the earth; problems relating to terrestrial longitudes and latitudes; the direction of Mecca with regard to other places on the earth; geography on a mathematical-astronomical basis; (*f*) theory of the sun; (*g*) theory of the moon; solar and lunar parallaxes; (*h*) syzygies, eclipses, appearance of the new moon; (*i*) fixed stars and lunar stations; (*j*) theories of the five planets; geocentric distances and magnitudes of the celestial bodies and spheres; (*k*) problems of spherical astronomy as subserving astrology (calculation of the twelve celestial 'domus,' of the 'applicationes,' of the 'projectiones radiorum,' of the 'directiones' and 'profectiones,' of the 'revolutiones annorum,' of the *mamarr*, of the planetary conjunctions, of the millenary periods).

Muhammadan astronomical writings, almost always in Arabic, can be classified under four groups:

(*a*) General elementary introductions which represent a perfected form of what the *Isagoge* of Geminus and the *Hypotheses* of Ptolemy were for the Greeks; belonging to this category—to cite only writings translated into European languages and edited—are: the *de Imaginatione Sphæræ* of Thebit (or Thābit) ibn Qurrah († A.D. 901), the compendium of Alfraganus or al-Farghānī († after 861), and the compendium of al-Jaghmīnī († 1344–45);[4] (*b*) systematic treatises corresponding in type to the *Almagest*, but more perfect—*e.g.*, the unedited work of al-Bīrūnī cited above; the Latin translation of the *Almagest* of Geber (or Jābir) ibn Aflaḥ, printed at Nürnberg, 1534, would belong to this category if it had not omitted all the mathematical and astronomical tables; (*c*) treatises of spherical astronomy for the use of calculators and observers; these are called *zīj* (plur. *zījāt*, *azyāj*, *ziyajah*); they presuppose a knowledge of the general principles of cosmography and consist essentially of tables for calculation, illustrations of the use of the tables, and indications as to the manner of solving problems of spherical astronomy (for the most part without demonstration); the only treatise of this kind published and translated is that of al-Battānī;[5] of the Persian treatise of Ulūgh Beg only the prolegomena (explaining the use of the tables) and the stellar catalogue have been edited and translated; (*d*) writings on special subjects—*e.g.*, stellar catalogues, treatises on instruments, etc.

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[1] Ibn Rushd, *Metaphysic*, Cairo, n.d. [1902], p. 65, l. 3 from end (ed. and tr. by C. Quirós Rodríguez, Madrid, 1919, bk. iv. § 13).

[2] P. 83 (Quirós, bk. iv. § 77). [3] See also above, I. x.

[4] This has reached us only in the Latin version of Gerard of Cremona († 1187), Paris, 1538. The part relating to the mathematical sciences has been translated into German by E. Wiedemann, 'Beitr. zur Gesch. der Naturwissenschaften,' xi. (*Sitzungsberichte der physik.-medizin. Sozietät in Erlangen*, xxxix. [1907] 74–101.

[5] *E.g.*, Muḥammad al-Akfānī as-Saḫāwī, *Irshād al-qāṣid*, Calcutta, 1849, p. 84 f.

[6] *Risālah fī-aqsām al-'ulūm al-'aqliyyah*, in the *Tis' rasā'il*, Constantinople, 1298 A.H. (1881). The same definition is found in the *Chahār Maqālah*, written in Persian about 1160 by Niẓāmī-i-'Arūḍī-i-Samarqandī (tr. E. G. Browne, Hertford, 1899 [extract from *JRAS*], p. 89).

[1] *Prolegomena*, bk. vi. ch. xvi. (tr. de Slane, iii. 145 f.).

[2] *Comm. de Cœlo*, bk. ii. ch. 57 (*Aristotelis Opera omnia cum Averrois Cordubensis commentariis*, Venice, 1562, vol. v. fol. 136r.–v.).

[3] According to the indexes of the chapters given in the catalogues of the Arabic MSS in Oxford and Berlin.

[4] *Sullāḳā Haunānāyā*, the course of astronomy of Barhebræus, ed. and tr. F. Nau (*Le Livre de l'ascension de l'esprit sur la forme du ciel et de la terre*, 2 pts., Paris, 1899–1900), although written (in 1279) in Syriac by a Christian bishop, belongs to this category.

[5] To which is to be added the Latin translation, made in the 12th cent. by Athelhard of Bath, of Maslamah al-Majrīṭī's recension of the tables of al-Ḫuwārizmī, ed. with an excellent German commentary by H. Suter, 1914.

3. Relation to Islām.—Muhammadan religious ritual bases some of its prescriptions on elements of an astronomical character. The hours within which each of the five daily ritual prayers is valid depend on the latitude of the place and on the epoch of the solar year; further, the legal time for the night prayer is between the end of the evening and the beginning of the morning twilight. The ritual prayer is not valid unless the face is turned in the direction of Mecca; hence the necessity of solving the astronomical-geographical problem of the azimuth of Mecca. The beginning and the end of the month assigned to the fast are determined not by the civil calendar, but by the actual appearance of the new moon; and the beginning of the daily fast is given by the morning twilight. Finally, special ritual prayers are prescribed at eclipses of the sun and moon, for which it is well to be prepared in time. All this presupposes a certain degree of astronomical knowledge; and, although the majority of theologians and jurists are not content with pure calculation for the appearance of the new moon, but require the actual sight of the phenomenon, it is evident that the religious precept must be a real stimulus to scientific study. This explains also why the Muhammadans have undertaken so much research into the complex phenomena of the twilight and of the conditions of visibility of the new moon—phenomena which were almost entirely neglected by the Greek astronomers. On the other hand, many passages of the Qur'ān set forth the benefits which God has vouchsafed to men by means of celestial bodies and motions; at least they invite reflexion on the goodness and providence of God. Astronomy thus becomes an ally of religion.

4. Sources.[1]—(*a*) *Arabian.*—A first element of an exclusively practical character is due to the Arabs before Islām. Like all other peoples who dwell in hot countries and are compelled to prefer night to day for travelling, the Bedawin made use of the stars for guiding their wanderings and for calculating (approximately) the hours of the night; they were thus familiar with the principal appearances of Venus and of Mercury, the places of the rising and setting of the more brilliant stars, and above all the annual course of the moon determined by noting its position in relation to 28 successive groups of stars called for this reason *manāzil al-qamar*, 'lunar stations.' Further, among the sedentary agricultural tribes, the seasons and many meteorological provisions (especially those for rain) were strictly connected with the annual rising of certain fixed stars[2] or else with the cosmic setting of the lunar stations. Hence, even in the 16th and 17th centuries, Arabic writers on astronomy still occupied themselves with the lunar mansions[3] and their *anwā'*, or cosmic settings.

(*b*) *Indian.*—The Muhammadans owe the first scientific elements of astronomy to India. In 154 A.H. (A.D. 771),[4] there came to Baghdād an Indian embassy one learned member of which introduced to the Arabs the *Brāhmasphuṭasiddhānta*, composed in Sanskrit in A.D. 628 by Brahmagupta. From this work (which the Arabs called *as-Sind-hind*) Ibrāhīm ibn Ḥabīb al-Fazārī drew the elements and the methods of calculation for his astronomical tables (*zīj*) adapted to the Muhammadan lunar year. Almost contemporaneously Ya'qūb ibn Ṭāriq composed his *Tarkīb al-aflāk*, 'The Composition of the Celestial Spheres,' which was based on the elements and methods of the *Brāhmasphuṭasiddhānta* and on other data furnished by another Indian scientist (K.n.k.h), who came to Baghdād with a second embassy in 161 A.H. (A.D. 777–778). It seems that almost at the same time there was translated into Arabic under the name *al-Arkand* the *Khaṇḍakhādyaka*, written about A.D. 665 by the same Brahmagupta, but containing elements different from those of his other work. Abū 'l-ḥasan al-Ahwāzī, a contemporary of al-Fazārī and of Ya'qūb ibn Ṭāriq, probably drawing on oral teachings of learned Indians, introduced to the Arabs the planetary motions according to al-Arjabhad (a corruption of Āryabhaṭa, the name of an Indian astronomer who wrote in A.D. 500). These Indian works had many imitators in the Muhammadan world up to the end of the first half of the 5th cent. of the Hijra (11th cent. A.D.); some astronomers (*e.g.*, Ḥabash, an-Nairizī, Ibn as-Samḥ) wrote contemporaneously books based on Indian methods and elements and books with Greco-Arabic elements; others (*e.g.*, Muḥammad ibn Isḥāq as-Sarakhsī, Abū 'l-Wafā', al-Bīrūnī, al-Ḥāzinī) adapted elements calculated by the Muhammadan astronomers to great artificial cycles of years constructed in imitation of those of the Indians. For one of the characteristics of the astronomical books of India is their representation of the mean motions of sun, moon, and planets by the number of their revolutions in cycles of millions of years, starting from the supposition that at the beginning of creation sun, moon, and planets were all in conjunction in a given degree of longitude (*e.g.*, at the first point of Aries), taken as the initial point of the celestial sphere, and that at intervals of millions of years they will all be in conjunction again at the same point.[1] Further, many treatises composed by the Arabs gave the roots of the mean motions for the meridian of Uzain (corrupted later into Azīn and Arin, the Sanskrit Ujjayini), supposed to be the central meridian of the inhabited earth (90° E. of the first Ptolemaic meridian). From those Indian books the Arabs also derived their first knowledge of trigonometrical sines, of course in the form employed in India, *i.e.* for arcs of 3° 45′ and for the radius of 3438′.

(*c*) *Iranian.*—A few years after the introduction of Indian astronomy, and before the end of the 8th cent. A.D., there was translated into Arabic the Pahlavī work entitled *Zīk i Shatroayār*, 'Astronomical Tables of the King,' a name which became in the Arabic version *Zīj ash-Shāh* or *Zīj ash-Shahriyār*. The original was certainly composed in the last years of the kingdom of the Sāsānids, since the tables were based on the epoch of Yazdagird III. (16th June, A.D. 632); its elements were derived, not from Persian observations, but from Indian books. It appears also that the roots of the mean motions were referred to the meridian of the mythical castle Kangdizh, which Persian epic legend placed in the Far East. The Arabic version met with great favour among the Muhammadans. We know that the astronomer and astrologer Mā Shā' Allāh († at the beginning of the 9th cent. A.D.) made use of it for his calculations, that in the first half of the 9th cent. Muḥammad ibn Mūsā al-Ḫuwārizmī had deduced from it the equations of the planetary motions, whilst he had drawn the mean motions from the *as-Sind-hind* and other elements from Ptolemy, and that Abū Ma'shar († A.D. 886) used it for his astronomical tables. After the 9th cent. A.D. the *Zīj ash-Shāh* rapidly fell into disuse; but a passage of az-Zarqālī (Arzachel) shows that towards the middle of the 11th cent. some astrologers in Spain still calculated the longitude of the fixed stars according to the tables of the Persians.

(*d*) *Greek.*—Last in chronological order is the influence of Greek astronomy. At the end of the 8th cent. or at the beginning of the 9th A.D. a rich patron, of the family of the Barmecids, Yaḥyā ibn Ḫālid († 191 A.H. [A.D. 807]), caused the *Almagest* to be translated for the first time into Arabic. But this book, full of difficulties and obscurities, could not, at first, compete with easier and more practical works of Indian and Persian origin. It acquired influence later, when the mathematical preparation of the Muhammadans was more advanced, and when better translations appeared. In the first half of the 9th cent. also Arabic translations were made of the *Geographia*, the *Tabulæ Manuales*, the *Hypotheses Planetarum*, the *Apparitiones* (φάσεις) *Stellarum fixarum*, and the *Planisphærium* of Ptolemy; the *Tabulæ Manuales* of Theon of Alexandria; the book of Aristarchus on the magnitudes and distances of the sun and moon; the *Isagoge* of Geminus; two tractates of Autolycus; three of Theodosius; and the little work of Hypsicles on the ascensions. To the 9th cent. also probably belongs the Arabic translation of the astronomical tables of Ammonius, of which we still find traces in the 11th cent., when they were remodelled by az-Zarqālī, to pass afterwards into mediæval Latin literature under the names of Humenus, Armanus, etc. Finally, there appear to have been translated in the same century the book of the constellations of Aratus and a book on the magnitudes and distances of the celestial bodies, which, falsely attributed to Ptolemy, is known by the Arabs under the name of *Kitāb al-manshūrāt*.

5. Some astronomical teachings.—We may here refer to some special points, which have an importance for the history of the general ideas of celestial phenomena. The only system received by the Muhammadan peoples was the geocentric. Aristotelian philosophy, the authority of Ptolemy, and the requirements of astrology were insurmountable obstacles to the conception of a heliocentric system, which, in any case, could not have been demonstrated by irrefutable reasons or, in the absence of telescopes, have procured any real advantage to practical astronomy. The lack of telescopes kept Muhammadan astronomers from becoming acquainted with other planets than those already known to the Greeks. The mode, too, of representing their motions is always that of the Greeks, viz. by means of combinations (sometimes very complicated) of eccentrics and epicycles; nor

[1] For details see Nallino, *'Ilm al-falak*, pp. 104–140, 313–323 (for Arabic sources), 149–180 (Indian), 180–188 (Persian), and 216–229 (Greek).

[2] Alois Musil and Antonin Janssen have found this usage still in vogue among the Bedawīn of Moab. Eduard Glaser indicates it for the Yemen.

[3] These correspond only approximately to the *nakṣatras* of the Indians.

[4] So al-Bīrūnī. On the other hand, Ibn al-Qifṭī (a source of less authority) has 156=773.

[1] This Indian idea occurs also in some Arabic works which are not astronomical—*e.g.*, Ibn Qutaiba, *Liber poësis et poëtarum*, ed. M. J. de Goeje, Leyden, 1904, p. 503 f.

do the modifications of certain parts of the planetary theories of Ptolemy introduced by some (*e.g.*, Naṣīr ad-dīn and Quṭb ad-dīn ash-Shīrāzī) depart much from this principle. Only among writers who are philosophers rather than astronomers do we meet with theories that supersede those of eccentrics and epicycles.[1] In any case, among them all, the Aristotelian and Ptolemaic doctrine of the circular form of celestial motions reigns supreme, for the elliptic orbit indicated by az-Zarqālī for Mercury[2] is merely a graphical construction on the lamina of the astrolabe, and not a theoretical representation.

(*a*) *Number of the spheres.*—The number of the spheres, *i.e.* of what in the Middle Ages in Europe were called 'heavens,' is eight in Aristotle and Ptolemy, viz. seven for the planets (including the sun and the moon) and one for the fixed stars. This number of eight is preserved by the first Arabic astronomers—*e.g.*, al-Farghānī and al-Battānī, for whom, however, these ideal spheres, created to satisfy the requirements of physics and not those of astronomy properly so called, had no practical importance. Still the number of eight, combined with the Aristotelian theory of solid spheres in which the heavenly bodies are infixed without being able to move themselves, did not easily agree with the other teachings of the Ptolemaic system. Aristotle, who was ignorant of the motion of the precession of the equinoxes, and who consequently held that the fixed stars are really immovable, assigned to the eighth sphere the apparent diurnal motion of the celestial vault from east to west, a motion which the eighth sphere impressed also on all the others. But Ptolemy, accepting from Hipparchus the precession of the equinoxes on account of which the fixed stars have a slow and continued increase of longitude, came implicitly to attribute to the sphere of the fixed stars two motions in opposite directions—one (diurnal) from east to west, and the other from west to east. Ptolemy had no occasion to notice and correct this contradiction, which was soon perceived by the Arabic writers. The contradiction would have been easily eliminated by supposing that the fixed stars moved by the precessional motion within their own sphere, supposed accordingly to be fluid and not solid; and perhaps al-Battānī had in mind the possibility of this hypothesis when he entitled ch. li. of his book[3] thus: 'Of the motion of the fixed stars, whether they move in their sphere, or whether the sphere moves with them.' Another solution of the difficulty would have been to suppose the fixed stars to be infixed in the convexity of the sphere of Saturn, itself naturally subjected, like all the planetary apogees, to the motion of the precession; then the eighth sphere, no longer containing the stars, would only have had the office of impressing the diurnal motion on the spheres below. This solution was actually given by Muhammadan writers, some of whom indeed took advantage of it for reducing the number of the spheres to seven, to conform with the seven heavens of the Qur'ān; but this was never accepted by the astronomers.[4] Therefore, when Ibn al-Haitham († 1039) introduced into pure astronomical teaching the doctrine of the solid spheres of Aristotle, it was necessary for the physical reasons set forth above to add a ninth sphere without stars, impressing on the other spheres diurnal motion. This ninth sphere, accepted by all the later astronomers, was called 'the universal sphere,' 'the greatest sphere,' 'the sphere of the spheres,' 'the smooth sphere' (*al-falak al-aṭlas*), 'the sphere of the zodiac,' 'the supreme sphere.' In general also the philosophers—*e.g.*, Avicenna and Ibn Ṭufail—accept these nine spheres; Averroës,[1] however, under the influence of Aristotle, cannot bring himself to exceed the number of eight. In the theological camp the nine spheres did not find many opponents, in spite of 'the seven heavens' mentioned in *Qur.* ii. 27; it was held that the specification of the number seven did not imply the negation of a superior number.[2] In fact, several theologians saw in the eighth and ninth spheres respectively the 'seat' (*kursī*) and the 'throne' (*'arsh*) of God mentioned in the Qur'ān.[3]

Doubts were not wanting, however, concerning the unity of the sphere of the fixed stars. Faḫr ad-dīn ar-Rāzī[4] informs us that Avicenna, in his book *ash-Shifā'*, declared: 'Up till now it has not been clear to me whether the sphere of the fixed stars be a single sphere or be several spheres, placed one above the other.' And Faḫr ad-dīn ar-Rāzī[5] adds that the hypothesis of the single sphere for all the fixed stars rests only on the assumption of the equality of their motions, but that this equality is not at all certain. He further says that, even if the equality of the motions were a certainty, he would not deduce from it the necessity of a single sphere bearing all the stars infixed in it. In face of these criticisms, one comprehends the scepticism of Niẓām ad-dīn al-Ḥasan an-Naisābūrī: 'In conclusion, to none of the ancients or of the moderns is the number of the heavens quite certain, either by the force of reasoning or by the way of tradition.'[6]

(*b*) *Order of the planets.*—The order of the planets followed by almost all the Muhammadan astronomers is identical with that of Ptolemy, although they recognize, together with the Greek astronomers, the lack of absolute proofs in the case of the two inferior planets and the sun. Without telescopes they could not see the transits of Venus and Mercury across the sun or determine the parallaxes of the planets situated above the moon. Some Arabic authors believed that they had perceived transits of Venus or of Mercury across the sun; but what they really saw was solar spots.[7] On the other hand, the postulates of astrology continued in the Muhammadan age to guarantee, from lack of scientific reasons to the contrary, the Ptolemaic series: moon, Mercury, Venus, sun, Mars, Jupiter, Saturn. Spain alone had astronomers who departed from this order. Jābir ibn Aflaḥ (*c.* 1140) held it more probable that Mercury and Venus were above the sun on account of their analogy to the superior planets in having epicycles and eccentrics, stations and retrogradations. Al-Biṭrūjī (*c.* 1200), moved by physical reasons connected with his special system of planetary notions, placed the sun between Mercury and Venus.

(*c*) *Obliquity of the ecliptic.*—The obliquity of the ecliptic with regard to the celestial equator is one of the fundamental elements of astronomical calculation. The Greeks, from Eratosthenes (230 B.C.), had assigned to it the constant value of 23° 51′ 20″; *i.e.*, they held it to be invariable. The astonishment of the Arabic astronomers must have been great when they found by their observations an obliquity sensibly less; at first they could not decide whether the discrepancy was due to a real diminution of the obliquity or to a defect in the ancient observations. Al-Battānī leaves the ques-

[1] Cf. below, § 6.

[2] In the *Libros del saber de astronomía*, iii. 280. In any case, the earth there occupies the centre of the ellipse and not one of the foci.

[3] Ed. Nallino, i. 124.

[4] Cf. Niẓām ad-dīn al-Ḥasan an-Naisābūrī, *Tafsīr* (in marg. to the *Tafsīr* of aṭ-Ṭabarī), 1st ed., i. 205 (comm. on *Qur.* ii. 27); Faḫr ad-dīn ar-Rāzī, *Mafātiḥ al-ghaib*, Cairo, 1308–10 A.H., ii. 60 (comm. on *Qur.* ii. 159).

[1] *Metaphys.*, Cairo, n.d. [1902], p. 66 (ed. and tr. Quirós, bk. iv. § 16).

[2] Niẓām ad-dīn al-Ḥasan an-Naisābūrī, *loc. cit.*; Faḫr ad-dīn ar-Rāzī, i. 260.

[3] See al-Qazwīnī, *Cosmography*, ed. F. Wüstenfeld, Göttingen, 1848, i. 54; the glosses on *Mawāqif* of 'Aḍud ad-dīn al-Ījī; E. W. Lane, *Arabic-English Lexicon*, 8 vols., London, 1863–93, *s.v.* 'Arsh,' etc.

[4] ii. 59; cf. Avicenna, *Ash-Shifā'*, Teherān, 1303–05 A.H., i. 175 (in the 6th ch. of the 2nd *fann* of the *Ṭabī'iyyāt*).

[5] ii. 59 and i. 259 f. [6] *Loc. cit.* [7] See § 7 below

tion undecided and declares that he chooses the excellent value found by himself (23° 35′), 'since this was observed by us with our own eyes; the other, on the contrary, was received through the information of others.'[1] Some, less prudent, deduced the theory of libration[2] from the discrepancies as to the obliquity of the ecliptic combined with those relative to the precession of the equinoxes. But the continued series of observations left no doubt by the 13th cent. that the obliquity of the ecliptic was subject to a very slow regular diminution,[3] which therefore came to be admitted by all the astronomers; in Europe, on the other hand, we must come down to Tycho Brahe (1546–1601) to see it affirmed in the midst of opposition which lasted through the greater part of the 17th century. The Muhammadan astronomers had no means of determining whether this diminution was continuous or periodical and within what limits it was contained.[4] Abū 'Alī al-Ḥasan (*c.* 1260), who had accepted the hypothesis of az-Zarqālī as to libration, believed that the obliquity oscillated between a maximum of 23° 53′ and a minimum of 23° 33′; Faḫr ad-dīn ar-Rāzī[5] admitted a continuous diminution on account of which the ecliptic will coincide one day with the equator and then will depart from it again, so that the Tropic of Cancer will pass to the south and that of Capricorn to the north. Naṣīr ad-dīn aṭ-Ṭūsī († 1274 A.D.) confined himself to setting forth the eight possible hypotheses as to the continuity or the periodicity of the diminution, without giving preference to any.

(*d*) *Precession of the equinoxes.*—The precession of the equinoxes, on account of which the equinoctial points retreat from east to west along the equator and cause a continuous increase in the longitude of the fixed stars (calculated precisely from the point of the vernal equinox or the first point of Aries), is one of the greatest discoveries of Hipparchus, accepted by Ptolemy. It was accepted by all the Muhammadan astronomers, who, from the first half of the 9th cent., assigned it a value much more exact than that of Ptolemy (36″ yearly), viz. 54″ 33‴; later, a continued series of observations indicated other values still more approximate to the true one. There remained a question which celestial mechanics alone has been able to solve with certainty: Is the precession to be regarded as continuous, so that in many thousands of years the retreating equinoctial points will accomplish the entire circuit of the ecliptic, or is it confined within limits so as to be reduced to one oscillation, more or less great, of the equinoctial points? The first hypothesis, which is the true one, is accepted by Ptolemy; the second was followed by some Greek astrologers after the Christian era, who held that the equinoctial points, after having advanced 8° in 640 years, retreated 8° in a similar lapse of time, returning thus to the primitive point. According to them, the precession was 45″ a year. Finally, it is necessary to note that, while some Indian writers are quite ignorant of the precession, others admit it in an oscillatory form with arcs of 54° or 48° (namely, 27° or 24° from the one part and from the other of ζ Piscium), which they imagined by gross mistakes and not for scientific reasons.

(*e*) *Hypothesis of libration or trepidation.*—The great majority of Muhammadan astronomers held that there was a continuous precession, rightly attributing the discrepancies concerning its value to the imperfection of the observations of the Greeks. We know only three writers of the second half of the 9th cent. who, through Indian influence, accepted the idea of the oscillatory precession in the empirical form of the Greek astrologers mentioned above and of the Indians. On the other hand, Thābit ibn Qurrah († 901) suggested that the discrepancies in the estimate of the annual precession were due in reality to an apparent irregularity of that motion, and that they were connected with the discrepancies relative to the obliquity of the ecliptic. In an epistle which is preserved by Ibn Yūnus he says that he had up till then kept his own calculations private, because he regarded them as uncertain and only provisional. It seems that these secret papers formed the tractate which has come down to us only in two unedited Latin translations under the title *De motu octavæ sphæræ* or *De motu accessus et recessus*.[1] In this tractate Thābit notes that, if all the known observations were exact, there would be a slackening and an acceleration in the motion of precession and in the increase and diminution of the obliquity of the ecliptic. In order to explain these apparently irregular variations, he proposes the following hypothesis:

> The eighth sphere, viz. that which contains the fixed stars, has a movable ecliptic, the extremities of whose axis rotate about the equinoctial points of an ideally fixed ecliptic inclined 23° 33′ in respect of the equator; the complete rotation on those two small circles, having 4° 18′ 43″ of radius, is accomplished in 4171½ lunar years. In this period the equinoctial points would seem to accomplish, with a motion not uniform, an oscillation of 21° 30′ (10° 45′ forwards and the same backwards); in a similar time there will take place an unequal variation of the obliquity.
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> The hypothesis of Thābit was received in its entirety in Europe by Purbachius (1423–62) and by his commentators Reinhold and Nonius. The oscillation of the equinoctial points is called by the Arabs *ḥarakat al-iqbāl wa 'l-idbār*, 'motion of advance and of retreat,' whence the Latin name *motus accessus et recessus*; this was also called in Europe *motus octavæ sphæræ*, in contradistinction to the motion of the ninth sphere, to which was attributed the motion of the continuous precession; finally, since the longitude of the fixed stars underwent the same oscillations of the equinoctial points, it was often called in Europe *trepidatio fixarum*. This does not seem to have had supporters among the Muhammadans of the East after the 11th century. It had greater fortune among the Muhammadans of the extreme West (Spain and Morocco). Towards 1060–70, at Toledo, az-Zarqālī, in order to make his observations agree with those of his predecessors, suggested that the poles of the ecliptic circulated about the equatorial poles, so that the equinoxes advanced by one unequal motion towards the east about 10° and then retreated irregularly by 20°, accomplishing, *i.e.*, an oscillation of 10° forwards and 10° backwards with reference to an equinoctial point ideally fixed. Every arc of 10° would have been passed over in 750 years, so that the complete cycle of the libration would be accomplished in 3000 years. The hypothesis of az-Zarqālī, explicitly denied by Averroës,[2] was accepted by al-Biṭrūjī (*c.* 1200) in Spain and by Abū 'Alī al-Ḥasan (*c.* 1260) in Morocco; it also found great favour among the Jews and Spanish Christians and had an influence on the Hebrews, who, on a basis of Arabic sources, compiled about 1270 the *Tabulæ Alphonsinæ*.[3]

(*f*) *Motion of the solar apogee.* — Ptolemy (followed by all the later Greeks) says that he found the longitude of the solar apogee to be equal to that observed by Hipparchus, and consequently believes that it is immovable at 65° 30′, while the apogees of the five planets move with the motion of the precession. It is a merit of the Arab astronomers of the khalīf al-Ma'mūn (813–833) that they recognized that the solar apogee is subject to the

[1] Ed. Nallino, i. 12.

[2] See below, § (*e*).

[3] This was already the opinion of Ḥāmid al-Ḥujandī, about A.D. 1000.

[4] Only in the second half of the 18th cent. has celestial mechanics been able to establish the fact that it is a question of a very slow oscillation contained within limits of less than 2½°.

[5] *Mafātiḥ al-ghaib*, i. 260, ii. 59 f.

[1] A suspicion arises, however, that this tractate may rather be by a grandson of Thābit, viz. Ibrāhīm ibn Sinān ibn Thābit, who wrote concerning libration (as al-Bīrūnī and Qāḍīzādeh attest).

[2] *Metaphys.* p. 66 (Quirós, bk. iv. § 15).

[3] It must be noticed that these Hebrews combined the hypothesis of Az-Zarqālī with fantastic elements: viz. they admitted a continuous precession accomplishing the circuit of 360° in 49,000 years (*i.e.* just about 26″ 27‴ a year), which precession was to be always corrected on the basis of an inequality accomplishing its own period in 7000 years. They evidently wished to introduce into the hypothesis of trepidation Judaic elements —a thousand jubilary periods of 49 years and a thousand sabbatical periods of 7 years!

motion of the fixed stars and of the planetary apogees, *i.e.* to the displacement of longitude due to the precession of the equinoxes. But the solar apogee has also another very small proper motion in longitude which, according to Leverrier, is only 11·464″ yearly. This motion must have escaped the Muhammadan astronomers. The determination of the longitude of the apogee is not easy and, in times when telescopes and pendulum-clocks were lacking, could not be effected with absolute certainty in the minutes of arc; on the other hand, there was no term of comparison with ancient observations. One understands, therefore, why the majority of Muhammadan astronomers did not give to the solar apogee any other motion than that of the precession, attributing the small discrepancies to the imperfection of instruments and observations. It seems that Thābit ibn Qurrah, however, had dared to affirm the existence of a *proper* motion. Al-Bīrūnī[1] informs us that Thābit, author of a tractate on the inequality of the solar year, had determined 365 days, 6 hours, 12 minutes, 9 seconds, as being the length of the year which we call anomalistic, *i.e.* the time which the sun takes to return to its own apogee. If, then, the same Thābit (if we may rely upon a piece of information which Regiomontanus and Copernicus seem to have derived from the *De motu octavæ sphæræ* cited above) determined the length of the sidereal year as 365 d., 6 h., 9 m., 12 s., it is plain that he must have attributed to the solar apogee a small proper motion added to that of the precession.[2] Certainly the values found by Thābit are excellent, since, according to the moderns, the anomalistic solar year is 365 d., 6 h., 13 m., 54·9 s., and the sidereal year 365 d., 6 h., 9 m., 10·7 s. It is beyond doubt that az-Zarqālī determined with great exactness ($12\frac{1}{29}\frac{1}{5}$″ every Julian year) the proper motion of the apogee, as distinguished from that due to the precession; and he therefore supposed that the centre of the eccentric of the sun moved over a very small circle, and by this was also settled the variation of the eccentricity of the solar orbit. Among us the proper motion of the apogee was discovered only in the 16th cent. by Kepler and Longomontanus.

(*g*) *Third lunar inequality.*—We need not notice other modifications of special points of Ptolemaic doctrines. It will be enough now to make a reference to a controversy carried on from 1836 to 1871 in the Academy of Sciences of Paris without any definite conclusion being arrived at, viz.: Is the discovery of the variation or third lunar inequality to be ascribed to Abū 'l-Wafā' († 998), as L. A. Sédillot maintained, rather than to Tycho Brahe? There would have been no reason for this dispute if that part of the *Almagest* relative to the movements of the moon had been better studied, and if the analogous discussions in the works of other Arabic astronomers had been examined with care. Carra de Vaux[3] has demonstrated that the hypothetical theory of the variation was nothing else than the *πρόσνευσις* of Ptolemy, *i.e.* the difference between the true and the mean apogee of the epicycle by which difference the mean anomaly is corrected so as then to calculate the simple equation of the moon. Al-Battānī opportunely calls it 'equation of the anomaly.' It is curious to note that no one has observed that already in 1645 Bullialdus (I. Boulliau) had recognized that the *πρόσνευσις* corresponded to about half of the 'variation' of Tycho Brahe, and that consequently the tables of Ptolemy for the moon were sufficiently near to the truth.

6. Opposition to Ptolemy.—The many modifications of the doctrines of the *Almagest* never abandon the geometrical foundation followed by Ptolemy for the representation of the motions of the sun and planets, viz. a combination of eccentric circles and epicycles. This permitted the representation of celestial motions with all the exactness of which astronomical instruments were capable before the discovery of pendulum-clocks and telescopes; it was further obedient to the Aristotelian principle that celestial motions are circular only. Practical astronomy therefore did not feel the need of theories based on different geometrical principles. The difficulty arose only from a physical point of view, since the idea of numerous circular motions round an imaginary point was repugnant to the principles of Aristotelian physics. It was precisely in the name of Aristotelian natural laws that the battle began among the Arabs of Spain in the 12th cent. against the eccentrics and epicycles of Ptolemy; but their opponents were philosophers.[1]

The first of these was Abū Bakr Muḥammad ibn aṣ-Ṣā'igh, known by the name of Ibn Bājah or Avempace († 1139), who is said to have explained the celestial motions by means of eccentrics only, rejecting the epicycles as repugnant to the physics of Aristotle; but we have no particular account of his system.[2] After him we find Abū Bakr ibn Ṭufail (*q.v.*; † 1185–86), famous in Europe for his *Philosophus autodidactus*, who said to al-Biṭrūjī that he had found a theory of those motions quite different from that of Ptolemy rejecting both eccentrics and epicycles, and that he had promised to put it in writing. But it seems that the promise was not fulfilled. The ideas of Ibn Ṭufail probably influenced his friend Averroës (*q.v.*; † 1198), who affirms[3] the physical impossibility of the geometrical hypothesis of Ptolemy. The astronomers, he continues, assign an eccentric to the moon because, since she is eclipsed now more and now less in one and the same point of the zodiac, they suppose that she traverses the cone of shade at different distances with regard to the earth. 'But this may happen also on account of the diversity of her position, if we imagine that the poles of the lunar sphere move around the poles of another sphere. If God shall prolong our life, we will investigate the astronomy of the time of Aristotle, since this seems not to contradict physics; it consists of motions which Aristotle calls *laulab* [*i.e.* spirals]. I believe that this motion consists in this, that the poles of one sphere move about the poles of another; since then the motion [resulting] is according to a line *leulebia* [*i.e.* spiral], just so is the motion of the sun [combined] with the diurnal motion [of the celestial sphere]. Perchance it is possible by means of such a motion to represent the inequalities which take place in the planetary motions.'

In his commentary on the *Metaphysic*, xii. 47,[4] Averroës does not succeed in forming a clear idea of the system of Eudoxus from the scanty allusions of Aristotle and from the commentary of Alexander of Aphrodisias, which is very defective in this part, it not being clear in what manner the 'motus gyrativi'[5] arise from two contrary motions, unless two different poles be supposed.[6] He observes that by this hypothesis one could explain all the appearances of the planets: 'et iste motus, ut mathematici Hispaniæ dicunt, existit in orbe stellato, et vocant ipsum motum processus et reversionis.'[7]

Although Averroës did not complete his exposition,[8] he had guessed a notable part of the hypothesis of Eudoxus (*c.* 409–356 B.C.), which was for the first time reconstructed by G. Schiaparelli in 1875. Averroës, like Eudoxus, allows only spheres concentric with the earth; he admits that the line *laulabī* may be the apparent result of two contrary circular motions—one of the sphere of the planets, and the other, in an opposite direction, of another sphere whose axis is inclined in respect of the axis of the first sphere; finally, the line *laulabī* corresponds to the *ἱπποπέδη* of Eudoxus, in the form of ∞, which, according to the Greek geometricians, belongs to the category of spiral lines (*σπεῖραι*), and, according to modern geometricians, would

[1] *Chronology of the Ancient Nations*, Eng. tr., London, 1879, p. 61 f.

[2] The fact that Thābit wrote a tractate to maintain that the solar apogee does move is of no importance, since it is probably merely a confutation of the Ptolemaic immobility.

[3] 'L'Almageste d'Abû 'l-Wéfa al-Bûzdjânî,' in *JA* VIII. xix. [1892] 440–471.

[1] Cf. L. Gauthier, 'Une Réforme du système astronomique de Ptolémée tentée par les philosophes arabes du XIIe siècle,' in *JA* X. xiv. [1909] 483–510; but this article is insufficient from a mathematical-astronomic point of view.

[2] See Maimonides, *Le Guide des égarés*, ed. and tr. S. Munk, Paris, 1856–66, ii. 185 f.

[3] *Comm. de Cœlo*, ii. 35 (*Aristotelis Opera omnia cum Averrois Cordubensis commentariis*, Venice, 1562, v. fol. 118v.–119r.).

[4] Ed. cit. viii. fol. 331v.–332r.

[5] Thus the Latin translator in the commentary on the *Metaphysic* renders the Arabic adjective *laulabī* 'spiral, in the form of a spiral or of a screw.'

[6] And, in fact, this was the hypothesis of Eudoxus.

[7] *I.e.* the motion of the libration of the fixed stars in the hypothesis of the Spaniard az-Zarqālī (see above, § 5, (*e*)).

[8] Cf. also ed. cit. viii. fol. 329v. (on *Metaphys.* xii. 45).

he a lemniscate described on a spherical superficies instead of on a plane. There naturally occur in the hypothesis of Eudoxus some special conditions, of which Averroës does not seem to have thought; one does not understand, then, how the Arabian philosopher thought to save himself from the greatest objection which could be made to the system of concentric spheres, viz. that by making the distance of the celestial bodies from the earth always equal it did not permit of an explanation of the variation of the diameters of the sun and moon.

Another friend and disciple of Ibn Ṭufail, al-Biṭrūjī (a native of Pedroche to the north of Cordova),[1] attempted a complete system as a substitute for the geometrical hypothesis of Ptolemy,[2] by placing the data of observation of the *Almagest* in agreement with the peripatetic philosophy. He says that, moved by discourses of Ibn Ṭufail to meditate on this question, he had arrived at new theories by a kind of divine revelation. He admits with Ptolemy the nine spheres concentric with the earth; on the other hand, he denies the eccentrics and the epicycles. He finds it to be contrary to natural order that, while the ninth sphere impresses on all the others the diurnal motion of rotation from east to west, the spheres below the ninth should have besides a motion of their own in an opposite direction. In order to remove this contradiction, he conceives a whimsical theory which betrays the inexperience of the author in the field of practical astronomy.

According to him, the movements of the planets and of the fixed stars in longitude take place in reality from east to west, like the diurnal motion of the rotation of the heavens; those movements which astronomers have judged to be from west to east are simply illusory appearances due to the progressive diminution of the angular velocity of the spheres, according as a gradual approach is made from the ninth sphere to the earth.[3] The ninth sphere accomplishes the 360° of circumference in 24 hours and communicates this motion to the spheres below; but the impulse grows weaker from sphere to sphere. That of the fixed stars, which is immediately under the ninth, accomplishes in 24 hours something less than 360°; and this little retardation brings it about that after 36,000 years[4] it has accomplished a whole circuit less than the ninth sphere and appears to be moving very slowly in a direction contrary to it. Under the sphere of the fixed stars comes that of Saturn, considerably slower; it accomplishes in the space of about 30 years[5] a whole circuit less than the ninth sphere. Thus Jupiter loses a whole circuit in 12 years; Mars in two; Venus, the sun, and Mercury in one; and the moon in a little more than 27 days. This, then, is the reason why all the spheres under the ninth appear to move in a direction contrary to it.

For physical reasons, therefore, al-Biṭrūjī believes that the sphere of Venus is to be placed above the sun and that of Mercury below it. There remain to be explained the inequalities of the motions of the sun, moon, and planets. He says that he drew inspiration for this from constructions analogous to that by which az-Zarqālī had imagined the motion of the libration of the fixed stars. While az-Zarqālī made the poles of the ecliptic rotate parallel with the plane of the equator, al-Biṭrūjī, in the case of the planets, made the poles of the planetary spheres move on inclined planes round the poles of the equator or of the ecliptic; from this it results that the planets describe lines *laulabinæ*, *i.e.* spiral, on a spherical superficies. Thus are also explained the stations and retrogradations of the planets. For this part, therefore, we have the partial resuscitation of the hypothesis of Eudoxus. The ideas of al-Biṭrūjī were accepted by a fair number of Christians and Jews in Spain and Provence; and they had also an echo in Italy in the 16th century.

7. Celestial physics.—As is said above,[6] celestial physics, according to Muhammadan and Greek writers, lies outside the field of astronomy; its problems are discussed in books of metaphysics, of physics in an Aristotelian sense, and of theology, or at least in special works, of which the greater part are now either lost or unedited.

Like Ptolemy, the most ancient Arabic astronomers neglect to define the idea of the celestial spheres and limit themselves to considering them in the mathematical aspect of ideal circles representing the movements of the heavenly bodies.

[1] Alpetragius of our mediæval writers.

[2] Of the book of al-Biṭrūjī there has been published only an obscure Latin tr. (Venice, 1531) made from a Hebrew version. The Latin tr. made in 1217 at Toledo by Michael Scotus is unedited, as is also the Arabic text.

[3] This idea was already maintained by the Iḫwān aṣ-Ṣafā' about the middle of the 10th cent. (see their *Rasā'il*, Bombay, 1305–06 A.H., ii. 22–26) and by Faḫr ad-dīn ar-Rāzī, *Mafātīḥ al-ghaib*, Cairo, 1308 A.H., ii. 60 f. (comm. on *Qur.* ii. 159) and vi. 117 *f.* (on *Qur.* xxi. 34). But they admit Ptolemy's eccentrics and epicycles.

[4] This is the period of time in which, according to Ptolemy, the fixed stars accomplish the circumference, proceeding towards the east.

[5] The duration of the heliocentric sidereal revolution of Saturn is a little less than 29½ years; it is, in the Ptolemaic hypothesis, the revolution of the centre of the epicycle of Saturn in the zodiac.

[6] See § 1.

The Aristotelian conception of solid spheres was introduced for the first time[1] into a purely astronomical treatise by Ibn al-Haitham; and he, in his unedited compendium of astronomy, gives the definition which was accepted afterwards by all the other writers of elementary treatises: 'A celestial sphere (*falak*, plur. *aflāk*) is a body completely spherical, bounded by two parallel spherical superficies having the same centre.'[2] In this, as he himself says, he drew his inspiration from the *Hypotheses Planetarum* of Ptolemy; in fact, as we see from a passage of Naṣīr ad-dīn aṭ-Ṭūsī, he followed the *Hypotheses* also in expounding how the celestial motions can be represented, and also by supposing simple equatorial zones of those complete spheres, so that the spheres of the epicycles become, as it were, tambourines (*duff*) rotating on their own axes, and the other spheres like armils.[3] This second form of representation was soon abandoned, as contrary to the principles of natural philosophy.

Muhammadan writers agree with Aristotle in holding that the spheres and the celestial bodies are a simple unique substance, different from the four elements of the sublunar world, and forming a fifth element. The solidity also of the spheres, by reason of which the stars remain infixed within them, and by which the stars are carried round, is accepted by almost all,[4] except a few theologians who, to support a strictly literal meaning of a passage of the Qur'ān,[5] maintain that the stars move within the spheres like fish swimming in water. The ideas of the majority of writers after the 4th cent. of the Hijra are those set forth in the dogmatic theology of al-Baiḍāwī († 1286) as follows:

'The spheres are transparent; since if they were coloured, our eyes could not possibly see that which is within them. They are neither hot nor cold; since otherwise the heat and cold would dominate in the elements of the sublunar world on account of their contiguity to it. They are neither light nor heavy; since otherwise in their nature there would be a tendency to rectilinear motion.[6] They are neither moist nor dry; otherwise the facility or difficulty of taking certain forms or of attaching themselves would be manifested in rectilinear motion. They are not capable of quantitative motion; since, if the convexity of the external superficies were to increase, it would be necessary that there should be a void above it, which is absurd; and the same is to be said regarding concavity, since if this were to increase it would be necessary that one sphere should enter into another or that between the two there should be a void.'[7]

So also it is proved by Aristotelian reasonings that the motion of the spheres must be circular.

The greater number of Muhammadan philosophers accept the peripatetic doctrine that the spheres and the stars are living beings, rational, operating by their own will; that the spheres have souls which exist in their bodies as our souls in our bodies; and that, as our bodies move under the impulse of our souls towards the ends we have in view, so also do the spheres, which have as their end the serving of God. This doctrine is for the most part repudiated by the theologians: al-Ghazālī († 1111) does not deny the possibility of it, but he affirms that we are incapable of knowing it; on the other hand, Ibn Ḥazm († 1064), Ibn Qayyim

[1] This follows from the preface itself of Ibn al-Haitham and from the attestation of Muḥammad al-Akfānī as-Saḫāwī, *Irshād al-qāṣid*, p. 85.

[2] Only the spheres of the epicycles are full, *i.e.* are true globes.

[3] These two forms of hypothesis are always found side by side for every planet, in bk. ii. of the *Hypotheses*, published for the first time (1907) in German according to the Arabic version which takes the place of the lost Greek text (in Ptolemy, *Opera astronomica minora*, ed. Heiberg, p. 113 ff.).

[4] The ancient Arab astronomers—*e.g.*, al-Battānī (i. 124)—leave the question uncertain.

[5] xxi. 34.

[6] According to the Aristotelian theory (*de Cœlo*, i. 8 f.), heavy bodies tend in a straight line towards the centre of the world, light bodies tend to withdraw in a straight line from the centre.

[7] *Maṭāli' al-anwār*, Constantinople, 1305 A.H., p. 262.

al-Jauziyyah († 1350), and many others absolutely deny life and intelligence to the heavenly bodies. The philosophers of the peripatetic school and several theologians (*e.g.*, al-Baiḍāwī) hold that the movers of the celestial souls and consequently of the spheres are pure intelligences. Concerning their origin al-Fārābī, Avicenna, and their followers maintain a Neo-Platonic emanatory theory: from the first principle emanates the first intelligence, and from this are derived all the nine spheres by means of successive triads always composed of intelligence, soul, and body, until one arrives at the final or active intelligence from which is derived all the material of the sublunar world. This theory is vigorously opposed by al-Ghazālī and the other theologians.

The question of the marks on the moon is either neglected or only hinted at in the works hitherto published. The idea that the moon had valleys and mountains like the earth—an idea set forth by several Syriac writers—did not harmonize with the Aristotelian conception of the nature of the heavenly bodies and so could not be accepted by Muhammadan writers.

Observation of the solar spots is almost impossible to the naked eye; Faḫr ad-dīn ar-Rāzī, however, explicitly affirms: 'There are those who believe that there exist on the surface of the sun spots, in the same manner as there are marks on the surface of the moon.'[1] These spots were actually seen on some occasions, but were erroneously believed to be transits of Mercury and Venus across the sun.

The comets and the other meteors (in an Aristotelian sense) were the subjects of observations and of numerous monographs. But, judging from the little that we know about them, Muhammadan writers followed in this matter the theories set forth by Aristotle in his books on meteorology.[2]

8. Conclusion.—The importance of Muhammadan astronomy in the history of science has been variously judged; sometimes Muhammadan astronomers have received excessive praise, sometimes unjust criticism, as if they had done nothing but preserve and transmit to Europe Greek science, improving it only in minor details. This harsh verdict is due not only to very imperfect knowledge of the Arabic writings on astronomy (of which the greater part is still unedited), but also to the fact that no account has been taken of the special conditions of astronomy in the glorious period of Muhammadan culture. The system invented by the Greek geometricians, and completed by Ptolemy, for representing all the celestial motions had mathematically all the precision that could be desired or attained by the use of the best instruments; it produced no sensible discrepancy between theory and the result of observation. The elliptic orbits of Kepler would not have given the theory greater perfection than it received from the complicated system of eccentrics and epicycles; the latter indeed had the advantage of preserving the Pythagorean and Aristotelian principle, which denied any but circular movement in the heavens. One must not forget that even in the heliocentric system of Copernicus the motions of the planets were still explained by means of combinations of epicycles — combinations which were in several cases less perfect than those employed by the Ptolemaic astronomy. To change the method of geometrical representation would therefore have been whimsical—a mathematical trick, which no datum of observation would have justified; and, in fact, those Arabs who wished to eliminate the eccentrics and the epicycles[1] were philosophers rather than astronomers, and they propounded their hypotheses from data based only on Aristotelian physics.

It is thus easy to understand how it was that, *e.g.*, the astronomers of the khalīf al-Ma'mūn and their successors saw no necessity for drawing from their observations of the movement of Venus[2] the final conclusion that Venus revolved round the sun. From the point of view of such phenomena as could be observed without telescopes, this second hypothesis had no higher value than that which made Venus revolve round the earth. In a word, celestial appearances gave no cause to shake the foundations of the geocentric system, which agreed very well with every religious notion, and which was supported by the authority of both Aristotle and Ptolemy, reinforced by a very potent element in Hellenistic and mediæval culture, viz. astrology. Giovanni Schiaparelli, in one of his monographs on Greek astronomy,[3] has set forth clearly the decisive influence which astrology, brought into Greece by the Chaldæan Berosus (3rd cent. B.C.) and consequently received with great favour by the Stoics and Neo-Pythagoreans, had in the abandonment of the heliocentric system of Aristarchus. Astrological doctrine, based on the immobility of the earth in the centre of the world, was irreconcilable with any system which made the earth revolve round the sun or round any other body; astrology was thus a very powerful additional obstacle to the abandonment of the geocentric idea. Further, we must not forget that it was only in the 17th cent. that European physics reached clear proofs of the diurnal rotation of the earth and justified elliptic orbits and the heliocentric system, and that the really irrefutable argument for the revolution of the earth round the sun was furnished only in 1728 by the discovery of the aberration of the fixed stars.

An essential condition of all astronomical progress is to have at disposal a long series of methodical observations; and in this matter Muhammadan astronomers were obliged to begin, so to say, from the foundation. Ptolemy was the last Greek observer; but not even all the observations which he says he made are true. In several cases of capital importance—*e.g.*, regarding the obliquity of the ecliptic and the longitude of the solar apogee —he gave as agreeing with his own observations data found about 270 years before his time by Hipparchus, thus causing certain elements to be believed constant which are really variable. In other cases—*e.g.*, regarding the precession of the equinoxes — his observations are very rough. Theon of Alexandria (4th cent. A.D.) and Proclus (5th cent.) do no more than accept Ptolemy's elements, in some ways aggravating his errors; accordingly, during the seven centuries from Ptolemy to the first flourishing of Arabo-Muhammadan astronomy, we have not even one observation which is of use to the science. The first task, therefore, of the Arabic astronomers was to revise all the Ptolemaic elements of the celestial motions; it was a time not to form new theories but to collect the indispensable elements of fact by means of continuous observations more accurate than those of the Greeks. This task was accomplished by the Muhammadan astronomers in a marvellous manner;

[1] *Mafātīḥ al-ghaib*, i. 259, on *Qur.* ii. 27.

[2] On falling stars see present writer's art. in *Rivista degli Studi Orientali*, viii. [1920] 375–388.

[1] See above, § 6.

[2] They found (contrary to Ptolemy) that Venus has the same longitude of apogee, the same eccentricity, and the same equation of centre as the sun; and so the true longitude of the centre of the epicycle of Venus is always equal to the true longitude of the sun. This was the same as to suppose that the orbit of Venus is an epicycle whose centre is always the true place of the sun and runs over the solar orbit; in other words, it was equivalent to making Venus a satellite of the sun.

[3] *Origine del sistema planetario eliocentrico presso i Greci*, Milan, 1898, § 55.

indeed, we must come down to the time of Tycho Brahe (1546–1601) to find observers and observations comparable to those of the Muhammadan Middle Ages. Further, by founding trigonometry in a modern sense and developing it to a high degree they furnished astronomical science with an excellent instrument for its work.

The influence of Muhammadan astronomy in Europe is so far-reaching that to treat of it at length would be to give the history of some centuries of European astronomy. From the 12th cent. to the end of the 15th the compendiums used in the schools were translated from Arabic or were based on Arabic writings; the astronomical tables and the processes of calculation were derived from Arabic works, among which must be classed (from the point of view not of their language but of their contents) the celebrated tables of Alfonso which were still used by many in the 16th century. Spherical trigonometry in Europe started from Arabic treatises; the famous Regiomontanus himself (1436–76) borrows more than appears on the surface from al-Battānī. Through the influence of these Arabic sources the ancient Latin technical terminology was greatly modified, and not only do Arabic astronomical terms enter into European languages, but Latin words acquire new significations by imitation of corresponding Arabic words. The words 'degree,' 'minute,' 'equation' (in its astronomical sense), 'equation of the centre,' 'argument' (of a table), and some others, owe their technical signification to ridiculously literal translations of Arabic writings. We cannot enumerate all that European astronomy owes to Muhammadan observers; it will be enough to recall that they rendered inestimable services even to writers of the 17th cent.—*e.g.*, Halley—precisely because they offered the only certain means of checking elements determinable only by a comparison with observations separated by long intervals of time. The books of Regiomontanus, Purbachius, Copernicus, Tycho Brahe, Riccioli, etc., cite the observations which were known to them of their Oriental predecessors. The theory and practice of instruments in Europe has also Arabic sources. Finally, we must not forget the influence exercised by the Arabs in the way of example. They infused into the Christians and Jews of Spain a passion for continued observations and an idea of the perfectibility of astronomical science; from Spain this passion and idea spread through the rest of Europe, preparing the way for modern astronomy.

The conditions of the Byzantine mediæval world were not favourable to the development of the sciences. Nevertheless, Muhammadan culture, which left many traces in Byzantine astrology, had also its part in astronomical studies. In 1323 an anonymous Greek introduced the Persian astronomical tables of Shams ad-dīn al-Buḫārī (Σὰμψ Μπουχαρής), which were at once widely used; in 1346 George Chrysococces made a new redaction of them, preserving at the same time many Arabic-Persian technical terms; and finally, about 1361, Theodore Meliteniotes reproduced these methods and these Persian tables in the third and last book of his Ἀστρονομικὴ Τρίβιβλος, after having set forth in the first and second books the methods and the tables according to Ptolemy and Theon of Alexandria. Thus there was created at Byzantium also a new astronomical terminology different from that of the classic Greek; and sometimes even Greek proper names appeared transformed by their passage through Arabic-Persian sources, as Θαούνης in place of Θέων.

LITERATURE.—There is no satisfactory exposition of the astronomy of the Muhammadan peoples in the Middle Ages; the general histories of astronomy—*e.g.*, those of F. Hoefer, J. H. von Mädler, R. Wolf (the best of all), and Arthur Berry—are inadequate, antiquated, and often erroneous. J. B. J. Delambre, *Hist. de l'astronomie du moyen âge*, Paris, 1819, pp. 1–211, and 513–539, is not a history but an analysis (of very unequal value) of various works of Muhammadan authors; the part devoted to the unedited book of Ibn Yūnus (pp. 76–150) is especially noteworthy, but it has the usual defect of Delambre—instead of the analyzed processes of the author, it substitutes a series of formulæ found by Delambre himself. Useful, but to be used with great caution, is L. A. Sédillot, *Matériaux pour servir à l'hist. comparée des sciences mathématiques chez les Grecs et les Orientaux*, 2 vols., Paris, 1845–49; see also his *Mémoire sur les instruments astronomiques des Arabes*, do. 1841 (*MAIBL, Savants étrangers*, i.). The present writer's Arabic book quoted above, p. 90[3], n. 1, concerns only the earliest period (summary of H. Suter, in *Bibliotheca Mathematica*, III. xii. [1912] 277–282). Many historical notices concerning the development of astronomical theories are to be found in the present writer's commentary on al-Battānī, *Opus astronomicum*, 3 vols., Milan, 1899–1907; short notices are to be found here and there in E. Wiedemann, 'Beiträge zur Geschichte der Naturwissenschaften,' nos. iii.–xxxviii. (in the *Sitzungsberichte der physikal.-medizinischen Sozietät in Erlangen*, 1904–1914) and in other small pamphlets by the same author. For biographical and bibliographical notices concerning individual writers see the excellent book of H. Suter, *Die Mathematiker und Astronomen der Araber und ihre Werke*, Leipzig, 1900, and 'Nachträge und Berichtigungen zu Die Math. und Astron.,' in *Abhandl. zur Gesch. der mathemat. Wissenschaften*, xiv. [1902] 157–185. For edd. and tr. of original texts see above, II. 2.

CARLO ALFONSO NALLINO.

SUN, MOON, AND STARS (Teutonic and Balto-Slavic). — I. *TEUTONIC.*—1. Archæological evidence.—The world-wide symbol of the sun-wheel occurs in the earliest Scandinavian rock-markings. Rude representations of horses and ships, which may have solar significance, are also found. In 1902 a curious object, apparently connected with the sun-cult, was discovered near Trundholm in Sweden. It is a representation of a disk, having gilding on one side and spiral ornamentation on the other, with a horse in front of it, both horse and disk being drawn on a waggon.

2. Solar myths.—Sun and moon, day and night, summer and winter, are personified in the poems of the older Edda. The Valkyrie Sigrdrifa invokes Day and the sons of Day, Night and her kinswoman.[1] Various passages from *Grimnismál*, *Vafþrúðnismál*, and *Völuspá* are summarized by Snorri:[2]

'Night, who was of Jotun race, married Delling, who was of Aesir race, and their son was named Day.' 'Then Allfather took Night and her son Day and set them up in heaven and gave them two steeds and two chariots and they were to drive round the earth every twenty-four hours.' The earth is bedewed by the foam which falls each morning from the bit of Hrimfaxi, the horse of Night. Day's steed is called Skinfaxi and he lights up the whole world with his mane. 'Then said Gangleri: "Who steers the course of the sun and of the moon?"' Mundilföri had a son Mani and a daughter Sol, whom the gods set up in heaven. 'They let Sol drive the steeds which drew the chariot of that sun which the gods made to light the world, from the sparks which flew out of Muspellheim [*i.e.* the world of fire and heat]. . . . These steeds are called All-Swift and Early-Awake, but under the withers of the horses, the gods set two wind-bellows to cool them, but in some old records that is called "isarnkol" [*i.e.* iron-coolness]. Mani steers the course of the Moon and rules over waxing and waning.'

The belief in the chariot and horses of the sun is very wide-spread; in Scandinavia, judging by the archæological evidence, it must have existed in very early times. We may have a reference to the same idea in Tacitus:

'Beyond the Suiones is another sea, sluggish and almost stagnant, by which the whole globe is imagined to be girt about and enclosed, from this circumstance that the last light of the setting sun continues so vivid till its rising as to obscure the stars. Popular belief adds, that the sound of his emerging from the ocean is also heard, and the forms of horses and the rays streaming from his head are beheld.'[3]

Like most other primitive people, the Scandinavians were struck by the phenomena of the eclipses, which they thought were caused by wolves.

'He who pursues her [*i.e.* the sun] is called Skoll; he frightens her and he will catch her; but he who is called Hati

[1] *Sigrdrifumál*, 2. [2] *Gylfaginning*, x.–xii.
[3] *Germ.* 45. Unfortunately the text is uncertain; some editors read *deorum* for *equorum* in the last sentence.

Hroðvitnison leaps in front of her, and he will catch the moon, and so it must be.'[1] 'Skoll is the name of the wolf, who pursues the gleaming goddess to Ironwood. Another called Hati, son of Hroðvitni, goes before the fair bride of heaven.'[2]

Sun and moon will be involved in the final world-catastrophe.

'Then said Gangleri: "Of what race are these wolves [*i.e.* Skoll and Hati]?" Hár said: . . . "The old giantess rears the sons of many Jotuns and all in the form of wolves, and it is said that of the race of these wolves, there shall come one mightier than all, called Moon-Swallower and he . . . in demon's form shall seize the moon. . . . He shall fill himself with the bodies of doomed men, he shall stain the god's abode with red blood; the sunshine shall be black, and all the weather treacherous during the following summer."'[2]

'Whence comes a sun, in the smooth sky,
When Fenrir [*i.e.* a monstrous wolf] has overtaken this one,
One daughter alone, shall the Elf-beam [*i.e.* the sun] bear,
Before Fenrir overtakes her.
The maiden shall ride on the mother's paths
After the Powers have perished.'[3]

3. Sun-worship.—Our knowledge of the religious practices of the Teutons is very meagre, and it is difficult to say how far the stories told in the two Eddas formed part of a living religion, even among the Scandinavians. We have, however, various references to the sun-cult from other sources. Procopius[4] describes how in the island of Thule [*i.e.* Scandinavia] the sun does not appear for 40 days at the winter solstice. At the end of this period messengers are sent up into the mountains to watch for the rising sun. They send word to the people below that the sun will shine upon them in five days: thereupon begins 'the greatest feast of the inhabitants of Thule.'

The positive side of Cæsar's well-known description of Teutonic religion[5] is probably true. The Teutons may well have acknowledged as gods such things as are 'objects of sight and by whose power they are apparently benefited, the sun, moon, fire,' although these were not their only deities. Observances in connexion with the sun and moon are forbidden in Christian sermons and penitentiaries. St. Eligius (588–659) tells his hearers that no Christian person 'calls sun or moon lords.' In the 11th cent. the *Decrees* of Burchard of Worms mention pagan traditions:

'Id est ut elementa coleres, id est lunam aut solem, aut stellarum cursum, novam lunam, aut defectum lunae, ut tuis clamoribus aut auxilio splendorem ejus restaurere valeres.'[6]

From Canute's Anglo-Saxon Laws[7] we learn that 'heathenship is to honour heathen gods, and sun or moon, . . . etc.' We have perhaps a trace of sun-worship in *Landnámabók*:

'Thorkell Moon, the law speaker, was of the best conversation of any heathen man in Iceland. . . . He had himself carried out into the rays of the sun in his death-sickness and commended himself to that god which had made the sun.'[8]

We know little of Anglo-Saxon paganism. Bede, however, mentions a goddess Eostur, in whose honour April was called 'Eosturmonath.'[9] The word 'Eostur' is identical with the Latin, Greek, Sanskrit, and Lithuanian names for the goddess of the dawn, or *Morgenröthe*, probably the same being who is referred to in the Lithuanian and Lettish folk-songs as the daughter of the sun.

Throughout Teutonic territory the first and second days of the week are named after the sun and moon. Sunna is mentioned with Wodan and Frûa in the Merseberg charm. Sol is counted as one of the *asynjur*.[10]

It is noteworthy that Snorri (see above) distinguishes between the physical sun and moon and the beings who rule over them and guide their movements. This distinction has been partly preserved in the Old Norse language, where the word *tungl* (A.S. *tungol*, Goth. *tuggls*, 'a star') denotes the actual moon, and Máni the supernatural being who directs his course. The same idea seems to underlie many of the Lithuanian and Lettish folk-songs.

1 *Gylf.* xii. 15. 2 *Grimn.* xxxix. 38.
3 *Vafþrúðnismál*, 46 f. 4 *De Bell. Goth.* ii. 15.
5 *De Bell. Gall.* vi. 21. 6 *PL* cxl. 960.
7 *Ancient Laws and Institutes of England*, ed. B. Thorpe, London, 1840, p. 162.
8 i. 9. 9 *De Temp. Ratione*, 15.
10 *Gylf.* xxxv. 45.

II. *Lettish, Lithuanian, and Old Prussian.* — **1. Mythology.** — Our chief knowledge of the solar mythology of the Baltic peoples is derived from Lettish and Lithuanian folk-songs, the most significant of which have been translated and analyzed by W. Mannhardt.[1] In these poems the changes which pass over the face of the sky, especially at dawn and sunset, are viewed as a drama, the chief actors being sun, moon, the daughter of the sun, the sons of God, Perkun, the thunder deity, 'God' and 'dear Maria'—the last two being as frankly pagan as the rest. Often, of course, the poems are confused and inconsistent, and it must be remembered that the terms 'sun,' 'moon,' etc., sometimes stand for the presiding deity, sometimes for the actual sun, etc., personified:

'The Sun, in the apple garden,
Weeps bitterly.
The *golden apple* hath fallen
From the apple tree.'[2]

(Here there is a clear distinction between the deity and the physical sun.)

'The Sun dances over the silver mountain,
Silver shoes she hath on her feet.'[3]

(In this case sun and sun-goddess appear to be one and the same.)

'God,' who was at war with the sun for three nights and three days, is evidently a sky-deity. The sky itself is described as a 'great water' or a mountain:

'The Sun with two gold horses
Rides up the rocky mountain,
Never heated, never weary,
Never resting on the way.'

(In this and in other songs we get the wide-spread myth of the horses of the sun.)

2. The sun.—The sun is called in many of the songs 'daughter of God,' in Lettish sources *saules-maat*, 'mother of the sun.' She is married to the moon, who is, however, an unfaithful husband.

'It happened in the spring-time
That sun and moon did wed,
But the sun rose up early
And from her the moon fled.
The morning star was loved then
By the lone wandering moon,
Who with a sword was smitten
In deep wrath by Perkun.'[4]

The children of the sun and moon are the stars, who are called orphans, because they appear only at night after their mother, the sun, has abandoned them.

3. The sons of God.—The morning and the evening stars play an important part in the folk-songs, sometimes as a single being, sometimes in dual form. In Lithuanian sources they are called Auszrine and Wakarine[5] and are described as the handmaids of the sun.

'"Dear sun, daughter of God,
Who kindles your fire in the morning?
Who spreads your bed in the evening?" . .
"Auszrine kindles the fire,
Wakarine spreads the bed."'[6]

In Lettish songs the morning and the evening stars are called the 'sons of God'—an epithet exactly equivalent to the Greek Dioskouroi. Like the Dioskouroi and the Aśvins of Indian mythology, the Lettish sons of God are connected with horses:

'Hither rode the dear sons of God
With steeds dripping with sweat.'[7]
'Folks say the moon has no steeds of his own.
The morning star and the evening star
They are the steeds of the moon.'[8]

1 'Die lett. Sonnenmythen,' *ZE* vii. 73–104, 209–244, 280–330.
2 *Ib.* p. 91 ff. 3 *Ib.* 4 *Ib.*
5 Nom. fem. of adjective derived from Lith. *auszra*, 'dawn, *vakaras*, 'evening.'
6 *ZE* vii. *loc. cit.* 7 *Ib.* 8 *Ib.*

4. The daughter of the sun.—A favourite theme of the Lettish folk-songs is the wooing of the daughter of the sun by the son of God, the sun providing the dowry, often most unwillingly.

'Why are grey steeds standing
By the house-door of the sun?
They are the grey steeds of the son of God
Who woos the daughter of the sun.
The son of God stretches out his hand
Over the great water
To the daughter of the sun.
The sun cries bitterly
Standing on the mountain.
Why should she not weep?
She sorrows for the little maiden,
She sorrows for the dowry,
For the chest which is laden
With gold and silver gifts.'[1]

This is a good example of a sunrise or sunset myth. The daughter of the sun is the red glow which is in the sky when the planet Venus appears, but soon afterwards melts into darkness or the full light of day. The 'dowry' seems to be the rays of the sun which light up the edges of the clouds and the tops of trees and mountains.

'The sun prepareth the dowry herself, gilding the edge of the forest of pines.'[2]

The daughter of the sun is almost certainly identical with the goddess mentioned by Lasicius.[3] 'Ausca dea est radiorum solis, vel occumbentis vel supra horizontem ascendentis.'[4]

5. Dear Maria.—Mannhardt considers that the name Maria has been substituted for that of various pagan deities, but it is also possible that she stands for a particular goddess, perhaps the Perkuna tete (*i.e.* the aunt of Perkun) mentioned by Lasicius: 'Perkuna tete is the mother of thunder and lightning; who receives into a bath the weary and dusty sun, and sends her out again next day washed and shining.'[5] Maria also presides over a bath-chamber:

'Behind the mountains smoke is rising.
Who is it hath kindled fire?
Dear Maria heats the bathroom
Where bathe little orphan maidens [*i.e.* stars].'[6]
'I ran down into the valley, into the bath-chamber of dear Maria.'[7]

According to Prætorius,[8] the Nadravians worshipped a star-god Szweigsdukks, who is evidently the Suaixtix worshipped by the Sudavians in Samland and equated with Sol in the *Constit. Synod. Evangel.* of 1530. Lucas David[9] calls Suaixtix the god of light and mentions him as one of the four deities who were invoked at agricultural festivals.[10] This deity seems to have been worshipped in both male and female form: 'They more commonly called this godhead Sweigsdunka, a star-goddess, whom they consider the bride of the sky and through whose power the morning and evening stars are guided.'[11] Is this perhaps 'the maiden who weaves star-coverings,' mentioned in one of the folk-songs, and also the goddess whose place has been taken by dear Maria, and who was also known as the aunt of the thunder-god? The underlying idea may be that she is a goddess of fire, light, and heat.[12]

6. Cult.—We know little of the sun-cult of the Baltic peoples, although we know from Peter von Dusburg[13] and Erasmus Stella[14] that sun, moon, and stars were worshipped as important deities. Prætorius[1] tells us that Bretkius (a historian of the 16th cent.) had observed that the Nadravians did honour to their gods by worshipping the different phases of the moon at various stages of their agricultural work.

In the course of his missionary journeys among the Lithuanians Jerome of Prague met with a people who worshipped the sun and who had a strange cult of a huge iron hammer. The priests justified this cult by telling Jerome that formerly the sun had been invisible for many months because a king had imprisoned it in a tower. 'The signs of the zodiac brought help to the sun, and broke the tower with the huge hammer, and restored the liberated sun to men, and therefore that which had been the instrument by which mortals had received light was worthy of veneration.'[2] According to Rendel Harris, the signs of the zodiac here stand for the Heavenly Twins or 'Sons of God': 'These and similar cases all arise out of the same theme, that the Sun (or the daughter of the Sun) has been carried off, or swallowed or imprisoned, and must be recovered.'[3] They use the hammer, the weapon of the thunder-god, because sacred twins are universally considered as children of the sky or thunder-god. In one of the Lettish songs they are described as 'workmen of Perkun.'

LITERATURE.—(I.) See works cited in art. NATURE (Teutonic). (II.) W. Mannhardt, 'Die lettischen Sonnenmythen,' *ZE* vii. [1875] 73–104, 209–244, 280–330; J. Rendel Harris, *The Cult of the Heavenly Twins*, Cambridge, 1906, *Boanerges*, do. 1913; see also art. OLD PRUSSIANS for further literature.

ENID WELSFORD.

SUN-DANCE.—See PHALLISM, ix. 823.

SUNDAY.—1. History of Sunday before the Christian era.—Only three times in the NT is there any reference to a religious observance of Sunday. St. Paul urged his converts at Corinth to put aside money for charity every Sunday (1 Co 16^2). Shortly after writing this he preached at a service held at Troas, which is mentioned as if it were a regular institution (Ac 20^7). Thirty years later, perhaps, the author of the Apocalypse wrote: 'I was in the Spirit on the Lord's day' (Rev 1^{10}). Though not quite conclusive, the evidence makes it probable that the observance of Sunday began among St. Paul's churches, which were predominantly Gentile. Now we cannot suppose that Gentile Christians, who were taught by St. Paul to protest against having the Sabbath imposed upon them, would yet accept from the Jews a whole system of reckoning time by weeks. It is important, therefore, to inquire how far the week was recognized in the Græco-Roman world independently of the Jews.

The week originated in Babylon, where it was invented for astrological reasons, but came to be used as a civil division of time. At first each month began with a fresh week, so that there were two or three odd days at the end. This was too inconvenient to last; and the weeks, emancipated from the month, ran on in an unbroken series. The gradual diffusion of Babylonian astrology carried a knowledge of the week into W. Asia, then into Egypt, and later still into E. Europe. The Israelites, when they invaded Canaan, found it established there and adopted it, as they did many other elements of Amorite culture; but the emphasis laid upon the Sabbath was their own.

In considering the recognition of the week in Europe it will be convenient to trace the evidence backwards. We may begin with Dio Cassius. Writing soon after A.D. 230, he says:

'The dedication of the days to the seven planets originated in Egypt, but has spread over all the world in comparatively

1 *ZE* vii. *loc. cit.* 2 *Ib.*
3 *De Diis Samagitarum*, in *Respublica sive Status regni Poloniæ, Lituaniæ, Prussiæ, Livoniæ, etc.*, Leyden, 1627, ch. viii.
4 Ausca, in Lith. Auszra, a word which is connected with Skr. *usas*, Gr. 'Ηώς, Lat. *Aurora*, O.E. *Eostur*, all of which (with the possible exception of Eostur) denote goddesses of the dawn.
5 P. 300. 6 *ZE* vii. *loc. cit.* 7 *Ib.*
8 *Deliciæ Prussicæ*, ed. W. Pierson, Berlin, 1871, p. 26.
9 *Preussische Chronik*, ed. E. Hennig, Königsberg, 1812, i. 86.
10 *Ib.* p. 91. 11 Prætorius, p. 26.
12 See art. NATURE (Lettish, Lithuanian, and Old Prussian).
13 *Scriptores Rerum Prussicarum*, Leipzig, 1861–74, i. 53.
14 *Ib.* iv. 294.

1 *Deliciæ Prussicæ*, p. 18. 2 Æneas Sylvius, in *ib.* iv. 239.
3 *Boanerges*, p. 334.